Geochemistry, Geophysics, Geosystems

Supporting Information for

Near Equilibrium ^{13}C-^{18}O Bonding During Inorganic Calcite Precipitation under Chemo-Stat Conditions

Nicholas P. Levitt[1,†], John M. Eiler[2], Christopher S. Romanek[3], Brian L. Beard[1], Huifang Xu[1], & Clark M. Johnson[1]

[1]NASA Astrobiology Institute and
Department of Geoscience
University of Wisconsin-Madison
1215 W Dayton Street
Madison, Wisconsin, USA
53706

[2]NASA Astrobiology Institute and
Geological and Planetary Sciences
California Institute of Technology
MC 100-23
Pasadena, California, USA
91125

[3]NASA Astrobiology Institute and
Department of Earth and Environmental Sciences
Furman University
Greenville, South Carolina, USA
29613

[†]Corresponding Author's Contact
E-mail: nlevitt@wisc.edu
Tel: (608) 262-8960
Fax: (608) 262-0693

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Previous Studies. A common method used to form solid carbonate from aqueous solution is by CO_2 degassing, which initially requires a relatively large amount of dissolved CO_2 that acts to lower *p*H and saturation state; when CO_2 degassing occurs, the saturation state of the solution increases and causes homogeneous nucleation of solid carbonate. Two sub-types of CO_2 degassing have been used: active (forced CO_2 removal, commonly by N_2) and passive (CO_2 flux due to pCO_2 difference between the solution and atmosphere). In both cases, the loss of gaseous CO_2 increases solution *p*H and consequently saturation state. A disadvantage of this approach is that CO_2 degassing methods require dynamic changes in solution compositions that lead to variable and sometimes uncontrollable precipitation rates (Kelson et al. 2017), and additionally risks kinetic behavior during homogeneous nucleation.

Tang et al. (2008, 2014, see also Dietzel and Usdowski, 1996 and Dietzel et al., 2009) performed CO_2 diffusion-based experiments and estimated precipitation rate according to an invariant calcite formation pace and modeled time-dependent surface areas. These experiments, however, relied on homogeneous nucleation of calcite from solution, raising the possibility of multiple reaction mechanisms and variable precipitation rates. In these experiments, supersaturation was achieved by titration of NaOH. Watkins et al. (2014) also used NaOH titration to maintain *p*H and facilitate calcite formation. Similarly, the researchers avoided heterogeneous growth on seed crystals and utilized CO_2(g) diffusion/dissolution to introduce DIC to the experimental solution. Precipitation rate determinations were calculated by reduction in Ca^{2+} concentrations, experiment length, and a calcite surface area approximation (Tang et al., 2008; 2014).

Current Study. Deionized water (NANOpure 18.2 MΩ, Thermo Barnstead, Bubuque, IA, USA) was used in our study. The source of the water was the Madison, WI, USA municipal water supply. This water was stockpiled in 50 L carboys at the beginning of the project to ensure a water source with a constant O isotope composition throughout the course of experimentation. Reagents used included calcium chloride ($CaCl_2*2H_2O$, ACS grade Lot: A0332898, Acros Organics [Geel, Belgium]) and sodium bicarbonate ($NaHCO_3$, 99.5% for analysis grade Lot:A0327974, Acros Organics [Geel, Belgium]). Seed

calcite was also produced from these reagents, however a ^{43}Ca spike was mixed into the $CaCl_2$ solution before precipitation to provide a quantitative method to determine overgrowth mass from the Ca isotope composition of the seed and final solid. The Ca spike (80% ^{43}Ca) was obtained from Oakridge National Laboratory (Batch: 219501, Oakridge, TN, USA).

The seed crystals were formed following the procedures of Ogino et al. (1987) and Rodriguez-Blanco et al. (2011). Specifically, 500 mL of a 0.61 M $CaCl_2$ solution was added to 600 mL of a 1.0 M $NaHCO_3$ solution. The reagent solutions had equilibrated at 20°C for 6 days prior to reaction. The reagent solutions were mixed into a water jacketed reaction vessel and maintained at 20°C for 16 days. The reaction solution was mixed with a magnetic stir bar during the 16 days. This time period allowed the conversion of vaterite to calcite. After 12 days an aliquot of the precipitate was collected, dried, and analyzed by X-ray diffraction (XRD) to confirm the presence of pure calcite. The seed crystals were additionally inspected for crystal habit by optical and electron microscopy. Solid was collected by decanting the reaction fluid into a 0.4 µm filtered (Isopore, HTTP membrane, Reference: HTTP04700, Lot: R4EA68008) vacuum system. The reaction vessel and calcite seeds were rinsed with DI water during filtration to prevent the formation of chloride salts. A small amount of methanol was used to help remove adsorbed water during filtration prior to further drying in an oven at 40°C for approximately 24 hours. Following oven drying, the seed crystals were checked again for mineralogy by XRD and then stored in a Dri-Rite filled desiccator until used. A Nova 4200e surface area and pore size analyzer (Quantachrome Instruments, Boynton Beach, FL, USA) was used to measure the surface area concentration of the seed crystal material according to the BET method (Brunauer et al., 1938). Additionally, the size distribution of seed crystals was assessed by depositing a distributed layer of calcite seeds onto Pelco Tabs (Prod. No. 16084-1, Ted Pella, Inc., Redding, CA, USA) and imaging the seeds with a Hitachi S-3400N scanning electron microscope utilizing backscattered electron (BSE) mode, an accelerating voltage of 15 kV, and a working distance of 10 mm. Image rastering was performed on a 3.8 mm by 1.76 mm area (Figure S1). A visual inspection of seed crystals indicates a bimodal distribution of (diameter) sizes of approximately 2 and 25 µm.

The experimental setup is shown schematically in Figure 1. Key components of the experimental process include a master solution which hosts precipitation, individual $CaCl_2$ and $NaHCO_3$ titrant solutions, and a separate set of 22 mM $CaCl_2$ and 24 mM $NaHCO_3$ solutions which experience CO_2/N_2 purging prior to use as reagents. After purging, the two reagent solutions were bubbled with pure CO_2 for approximately 1 hour at room temperature to decrease the *p*H prior to master solution formation so that the mixture would be undersaturated with respect to $CaCO_3$. The master solution was prepared by mixing 250 mL of each reagent solution into a temperature controlled water-jacketed vessel. Water was circulated through the jackets by a heating/refrigerating water bath (Anova Inc., Model: A&C Series, Stafford, TX, USA). The $CaCl_2$ and $NaHCO_3$ solutions were visually monitored during mixing to verify the absence

of homogeneous nucleation as indicated by appearance of a white cloudy area in an otherwise very clear solution. The remaining 750 mL of each reagent solution were transferred to temperature controlled water-jacketed vessels and used as titrant for the following experiment. Soon after mixing, the master solution and new titrant solutions were incorporated into the experimental setup as shown in Figure 1 and introduced to a CO_2/N_2 gas mixture atmosphere as described in detail below to allow DIC and pCO_2 to reach a steady state at the desired supersaturation. Master solution *p*H and temperature were monitored during this equilibration period (normally several hours) and after approximately 1 hour of stable *p*H the experiment was initiated by introduction of seed crystals and commencement of titration.

Titration of the master solution was accomplished by moving solutions through Masterflex santoprene tubing (model 6431-26, Gelsenkirchen, Germany) tubing with a Masterflex L/S peristaltic pump (model 7551-10) during experimentation. A Masterflex L/S (model 7534-04) multi-channel pump head was used to accommodate multiple tubes at the same time. The solution pCO_2 was controlled by introducing a CO_2/N_2 gas mixture flowing through the master solution reaction vessel. Gas was delivered by mass flow controllers (model F-201CV, Bronkhorst USA, Bethlehem, PA, USA). The partial pressure of CO_2 was established by mixing pure CO_2 and N_2 to total mixing ratios as indicated in Table 1. As an example, a pCO_2 of 15% was achieved by combining flow of 15 mL/minute of CO_2 and 85 mL/minute of N_2. Flow rates (individual and combined) were verified by a soap film flow meter (model 0101-0113, Hewlett-Packard (HP), Palo Alto, CA, USA). Measured Ca^{2+}, alkalinity, and *p*H were used to model solution pCO_2 for each experiment with PHREEQC software (Parkhurst and Appelo, 2013) and phreeqc.dat database to verify static conditions. Most calculated CO_2 partial pressures were within 1% of values set by mass flow controllers and all values average an offset of -0.1%. Individual values are included in Table A1. Pre-purified tanks of nitrogen gas and a single pre-purified tank of CO_2 gas (both from Scott-Gross Company, Inc. [Madison, WI, USA]) were used for all experiments in this study.

Chemostat precipitation experiments took place in an open-system with respect to O and C, where these elements were constantly moving through the reaction vessel in the form of CO_2 introduced to help maintain *p*H (further details below). This flux of $CO_{2(g)}$ may cause changes in the isotope composition of DIC and even H_2O if the CO_2 has not experienced extensive mixing (and reaction) with the solution water before it enters the precipitation system. To avoid this problem, a CO_2-H_2O exchange system was used prior to introducing CO_2/N_2 gas to the master precipitation solution. The design and viability of this equilibration system has been described previously (Levitt and Romanek, 2016). Briefly, the equilibration system is composed of three basic parts: 1) a reservoir to facilitate the mixing and reaction between CO_2 and H_2O, 2) equipment and materials used to introduce water and gas to the mixing reservoir, and 3) a vessel used to separate the reacted gas and water. The reservoir used to facilitate the isotope exchange reactions was approximately 288m long and designed to extensively mix water and gas phases. The same water used for precipitation experiments was also used

in the exchange system during the time period of experimentation. This system effectively allows the CO_2 entering the reaction vessel to exchange with the solution water (and by extension DIC) before ever entering the reaction solution.

Another factor to consider during calcite synthesis is the DIC used to form solid carbonate. The source of alkalinity used for these experiments was $NaHCO_3$. The isotope composition of this reagent is unknown. However, the C and O isotope compositionss of the DIC produced by this reagent are effectively replaced prior to being used for experimentation. This was achieved through the protocols described in the preceding paragraphs. Again, dissolving $NaHCO_3$ in stock DI water several (4 to 10) days before being used to precipitate calcite allowed this fresh solution to be bubbled with a CO_2/N_2 mixture prior to experimentation. Before entering the fresh (sodium) bicarbonate solution, the CO_2/N_2 mixture was used to help maintain the *p*H of a different actively precipitating master solution. In this way, a fresh solution was thoroughly flushed with "reagent" CO_2 (i.e. CO_2 that had been treated in the CO_2-H_2O exchange system, see Figure 1) prior to use.

Geochemical Analyses

Solution Ca^{2+} concentrations were determined at the UW-Madison Water Science and Engineering Laboratory with a Dionex (Model ICS-1100 RFIC, Sunnyvale, CA, USA) ion chromatograph. The instrument utilized a ER3b cation assembly cation column (P/N 067803), D56 heated conductivity cell, a 100 µL sample loop, and Dionex CSRS-300 suppressor. The analysis employed 20 mM methanesulfonic acid as an eluent and calibration solution matrices were prepared to mimic those of analyte solutions. Analytical precision is estimated as the 2SD value of concentration standards run as unknowns (± 1.1 mmol L^{-1}, n=3). Alkalinity was measured with a Mettler Toledo (Model DL50 Graphix, Greifensee, Switzerland) auto-titrator using an equivalence point titration (EQP) which was shown to be accurate to within 0.2 milliequivalents $L^{-}1$ (meq) or 1% of the test solution concentration. Each solution was analyzed for alkalinity three or more times and average 2-standard deviation of individual solution analyses (≥3) was 0.07 meq. *p*H was monitored before and during reaction with a Cole-Parmer electrode (Item #00289LY, Vernon Hills, IL, USA) and Oakton meter (Bench 2700 Series, Eutech Instruments, Vernon Hills, IL, USA). The electrode was calibrated before each experiment with Fischer Certified buffer solutions (Lots: 133436, 133435, 132388, Waltham, MA, USA). Details regarding solution composition for each experiment are provided in Table 1.

Calcium was purified prior to isotope analysis by ion-exchange chromatography similar to that reported by Li et al. (2012). Approximately 0.25 mg of calcite or 2.5 mL of reaction solution was processed for Ca isolation. Calcite was dissolved in dilute ultra-pure nitric acid and converted to pure $Ca(NO_3)_2$ before purification. Likewise, nitric acid was added to experimental solutions and dried until only solids remained. These solids were repeatedly dissolved with nitric acid and re-dried three times to ensure all cations were transformed into nitrate salts. Calcium was isolated and purified from other

cations by ion-exchange chromatography before isotope analysis. Element separation was achieved on Bio-Rad (Hercules, CA, USA) AG 50Wx8 200-400 mesh cation resin. This procedure consisted of following steps: 1) addition of sample to a chromatography column using 0.5 M HNO_3 solution, 2) elution of Na and impurity ions with 7 mL of 0.5 M HNO_3, and 3) removal from resin and collection of Ca with the addition of 3 mL of 8 M HCl.

Calcium isotope analyses were performed using a Micromass IsoProbe MC-ICP-MS at the University of Wisconsin-Madison. Helium was used as the collision gas for thermalization and H_2 was used to suppress argide isobars by charge transfer reactions. Ca solution concentrations of 10 ppm were introduced to the Ar plasma using a self-aspirating 50 to 100 µL min^{-1} nebulizer coupled to a Cetac Aridus II membrane desolvating system. The cone voltage was set to 200 to 500 V. These settings allowed Ca ion intensities of 44.5, 0.34, 0.07, and 1.22 V at mass numbers 40, 42, 43, and 44, respectively. A 2% HNO_3 solution was used as a rinse solution between individual sample measurements. The sample solutions were also measured using a standard-sample-standard bracketing protocol. Concentration-related matrix effects were corrected according to standard solutions ranging from 5 to 15 ppm Ca, as outlined by Albarède and Beard (2004). Further data processing included the subtraction of on-peak zero voltages using 60 s on-peak acid blank measurements prior to forty 10 s on-peak integrations of the analyte solution. Typical (2 standard deviation) precision for standards during these analyses was ± 1.07 ‰ for $^{43}Ca/^{42}Ca$. Individual analysis values and uncertainty are presented in Table A1.

Carbonate C and O isotope analyses as well as clumped isotope analyses were performed on two Thermo-Finnigan MAT 253 (Thermo Scientific, Bremen, Germany) isotope ratio mass spectrometers according to the procedures outlined by Passey et al. (2010). A single analysis consisted of digestion of 8-10 mg calcite in a common phosphoric acid bath at 90°C followed by an automated CO_2 purification process. See Passey et al. (2010) for automation and sample preparation details. Carbon and O isotope ratios for sample and standard material were determined by Isodat software with comparison to an Oztech reference gas of known isotope composition. Data presented in the main document was corrected for ^{17}O according to Santrock et al. (1985). Data was also corrected for ^{17}O using "Brand" parameters (Brand et al. 2010) according to the recommendations of Daeron et al. (2016). A comparison between the data processed by these two methods is presented below.

An O isotope acid fractionation factor of 1.00821 (Swart et al., 1991) was used to correct the $^{18}O/^{16}O$ ratio of gas phase CO_2 produced by acid digestion back to reactant calcite $\delta^{18}O$ values. All clumped isotope data are reported in the absolute reference frame (ARF) of Dennis et al., 2011 using equilibrated CO2 gases. Values of Δ_{47} measured for CO_2 produced from acid digestion of calcite at 90 ˚C have been corrected by 0.082‰ to make them equivalent to the frequently used reference frame of carbonates reacted at 25 ˚C (Deflies et al. 2015). In addition to unknown samples, standard reference

material was also analyzed in tandem during each analytical session. Carbonate reference materials included in-house standards "CIT Carrara" and "TV03" as well as National Institute of Standards and Technology Reference Material 8544 NBS19 Limestone (NBS-19). These reference materials averaged -0.31‰, -0.33‰, and +0.012‰ different than their accepted values for $\delta^{13}C$, $\delta^{18}O$, and Δ_{47} during the analytical session of September 2014 (Week 4 in Supporting Information Tables). Therefore, these values were used to correct each individual unknown analysis during this analytical session. After these adjustments, the 2-SD external precision (standard deviation about the mean) of carbonate standards analyzed during all 8 analytical sessions were 0.11‰, 0.27‰, and 0.034‰ for $\delta^{13}C$, $\delta^{18}O$, and Δ_{47} values. Each experimental product was analyzed a minimum of three times (thus standard errors for averages of replicated samples are, on average, 0.06, 0.16 and 0.020 ‰ or better, 2SE, respectively).

Oxygen isotope ratios for water were determined using a Laser Water Isotope Analyzer V2 (Los Gatos Research, Inc., Mountain View, CA, USA) and standardized using working materials that were calibrated to International Atomic Energy Agency standard reference materials VSMOW, Greenland Ice Sheet Precipitation (GISP), and Standard Light Antarctic Precipitation (SLAP). Water samples analyzed at the UC-Davis Stable Isotope Facility were grouped as follows: Data set #1 includes samples from experiments UWAI-002 through UWAI-019 while data set #2 includes samples from experiments UWAI-020 through UWAI-046. "Internal Checks" for water analyses provided by the UC-Davis Stable Isotope Facility are reported as follows: The data set #1 known value was -4.95‰ and the data set #2 known value was -2.83‰. The measured values for these two internal standards were -4.95 ± 0.34‰ and -2.83 ± 0.10‰, respectively. DIC C isotope analyses utilized a Delta V Plus (Thermo Scientific, Bremen, Germany) isotope ratio mass spectrometer to determine ratios of evolved trace gas phase CO_2. The IRMS system was interfaced with a Finnigan Gasbench II device for sample preparation and transfer. DIC analysis was similarly standardized according to materials traceable to National Institute of Standards and Technology reference material 8545. DIC samples analyzed at the UC-Davis Stable Isotope Facility were grouped as follows: Data set #3 includes samples from experiments UWAI-002 through UWAI-019 while data set #4 includes samples from experiments UWAI-020 through UWAI-046. "Internal Checks" for DIC analyses provided by the UC-Davis Stable Isotope Facility were performed on 0.2 mL of a 10 mM Li_2CO_3 material from Acros2 and are reported as follows: The data set #3 known value was -3.70‰ and the data set #4 known value was -4.00‰. The measured values for these two internal standards were -3.69 ± 0.08‰ (n=8) and -4.04 ± 0.06‰ (n=5), respectively.

Product carbonate was analyzed for mineralogy with a Rigaku (Model: D/max Rapid II-S, Tokyo, Japan) XRD system with a 2-D image plate (Mo Kα radiation) at the S. W. Bailey X-ray Diffraction Laboratory of the University of Wisconsin-Madison. Overgrowth mineralogy was verified by microscopy inspection as well as XRD. A Hitachi S-3400N scanning electron microscope utilizing backscattered electron (BSE), an accelerating

voltage of 15 kV, and a working distance of 10 mm was used for imaging. A representative SEM image and XRD patterns are provided as Figure S1 and S2. In all cases, only calcite was identified in reaction products.

Supporting Discussion Section

Data Treatment and Comparisons

The carbonate clumped isotope data reported in this paper have been subject to three corrections that are commonly used in the CO_2 and carbonate clumped isotope literature: 1) we correct measured differences in Δ_{47} between a sample-derived CO_2 gas and an intralaboratory CO_2 standard ('Oztech working gas') to account for non-linearity in 47/44 ratios — that is, a dependence of Δ_{47} on R47. This is done by documenting the correlation of measured Δ_{47} with R47 for gases equilibrated to a uniform temperature (the so-called 'heated gas' method described in Huntington et al., 2009). 2) Linearity-corrected Δ_{47} values are converted to the absolute reference frame of Dennis et al., 2011, by comparison with gases equilibrated at two known temperatures. And 3) Δ_{47} values of CO_2 extracted from calcite at 90 ˚C are converted to equivalent values for CO_2 extracted from calcite at 25 ˚C by adding 0.082 ‰.

We also perform a fourth correction to measurements of synthetic calcites grown from seed crystals, to account for the fact that analyzed material is a mixture of seed-crystal calcite and newly grown calcite (see example calculation below). This additional step is applied between corrections 2 and 3, above (though it could be performed at some other stage without significant differences).

As stated in the main document, the expression used to calculate bulk C and O isotope composition of overgrowth carbonate is

$$\delta_o = \frac{\left(\delta_{tot} - \delta_s(1-\chi)\right)}{\chi}$$

where δ_o is the isotope composition of the overgrowth, δ_{tot} is the measured isotope composition of the overgrowth plus seed crystals, δ_s is the isotope composition of the seed crystals, and χ is the mass fraction of overgrowth to final total carbonate. While this equation is not exact because it assumes linearity in terms of δ notation, tabulated values are accurate to 0.03‰ in the range of $\delta^{13}C$ and $\delta^{18}O$ values reported here, and hence do not significantly affect corrected δ values. An analogous correction for overgrowth Δ_{47} values requires a more complex calculation because mixing of two materials with distinct ^{13}C-^{18}O bonding cannot be treated as linear. We followed the procedure outlined in "Appendix A. Non-linearity of trends in 'Keeling plots' based on Δ_{47}" presented in the work of Affek and Eiler (2006) to isolate the overgrowth Δ_{47} value of reaction products (see example calculation below). This calculation (Equation A7 in Affek and Eiler, 2006) requires knowledge of the C isotope composition, O isotope composition, and Δ_{47} value of the seed crystals as well as the C isotope composition of overgrowth, O isotope composition of overgrowth, ratio of seed crystal mass to overgrowth mass, and Δ_{47} value of the total experimental product (seed crystals plus overgrowth).

There is an additional step in processing raw mass spectrometric data to reported $\delta^{13}C$, $\delta^{18}O$ and Δ_{47} values that has only recently been identified as a possible source of error (Daeron et al. (2016), Olack and Colman (2016), Schauer et al. (2016)). The central issue is that all previously reported clumped isotope measurements of CO_2 (including this study) have been made on sector mass spectrometers that cannot separate $^{13}CO_2$ from $^{12}C^{17}O^{16}O$, or $^{13}C^{18}O^{16}O$ from $^{12}C^{18}O^{17}O$ and $^{13}C^{17}O_2$. For these reasons, it is necessary to estimate the $^{17}O/^{16}O$ ratio of a sample based on the measured $^{18}O/^{16}O$ ratio (which is constrained by measuring R46). There are two established protocols for making such corrections: Santrock et al. (1985) and Brand et al. (2010). The most important difference between these two is the estimated $^{17}O/^{16}O$ ratio of Vienna Standard Mean Ocean Water (VSMOW). It is now generally recognized that the Brand estimate of this ratio is more nearly accurate. However, most previously reported carbonate clumped isotope data was processed assuming the Santrock parameters. The difference between Δ_{47} values derived from these two sets of parameters scales with the true difference in $\delta^{13}C$ between the sample and reference gases, and can reach ~0.1 ‰ in extreme cases. The community of carbonate clumped isotope researchers is in the process of re-examining and revising previously published works that used the Santrock parameters. Here we present our data using the Santrock parameters in order to maintain consistency with previously published experimental and empirical calibrations of the carbonate clumped isotope thermometer. However, we also processed our data using the Brand parameters to establish what effect this difference makes on our findings.

We used the procedures outlined in Daeron et al. (2016) to reprocess our data according to "Brand" parameters. These values are presented in Table A4. Similar to the observations of Daeron et al. (2016) and Kelson et al. (2017), the slope of our Δ_{47}-T relation following an error weighted regression is not significantly changed by this conversion (Figure S14). However, our Δ_{47} values decrease by approximately 0.045‰ at 25°C when cast into the ARF ($\Delta_{47} = (0.0494 \pm 0.012) \times 10^6 T^{-2} + (0.1098 \pm 0.14)$). This observation is consistent with the shifts in Δ_{47} for 23°C CO_2-H_2O equilibrated samples when compared in the "two reference frame" exercise reported by Schauer et al. (2016). Specifically, sample CO_2 will decrease in Δ_{47} when converted from "Santrock" to "Brand" corrected values if reference frame gases have more negative $\delta^{13}C$ values compared to the analyte C isotope composition. Our calcite (overgrowth + seed) $\delta^{13}C$ values ranged from -1.1 to 4.4‰ while reference frame gas $\delta^{13}C$ values were approximately -10.8‰. Like our data reported with a "Santrock" ^{17}O correction, Δ_{47} values derived with "Brand" parameters do not show a correlation to precipitation rate.

Additional Discussion of Isotope Modeling

Watkins and Hunt (2015) build on the ion-by-ion growth model developed in the work of Wolthers et al. (2012) and Watkins et al. (2014) to account for kinetic fractionation of C, O, and clumped isotopes during calcite precipitation. The model is grounded in the mathematical expressions of ion attachment (Ca and (bi)carbonate) and detachment fluxes at a mineral surface. In this model, calcite grows when the attachment flux

outpaces detachment flux and calcite dissolves when detachment flux outpaces attachment flux. The isotope composition of DIC species is accounted for based on a series of equilibrium fractionation factors. Ultimately, isotope fractionation between solution and calcite as a consequence of net ion flux is tied to a "kinetic limit" for a fast precipitation rate and an "equilibrium limit" at a slow precipitation rate. The kinetic limits are based on experimental work of Watkins et al. (2014) for O, Romanek et al. (1992) for C, and the theoretical calculations of Hill et al. (2014) for ^{13}C-^{18}O bonding. The equilibrium limits are based on the publications of Coplen (2007) and Bottinga (1986) for C, Coplen (2007) for O, and Coplen (2007) and Kluge et al. (2014) for clumped isotopes. The calcites in the "kinetic limit" studies exhibit isotope fractionations of lower magnitude compared to the "equilibrium limits". The precipitation rates of reference "limits" are known and isotope fractionation interpolation is tied to the ion-by-ion growth flux."

Watkins and Hunt (2015) provide a compilation (Table 1) of equilibrium fractionation factors used in their model. We follow this convention in our replication of their model calculations. These values have also been used in this work to determine C isotope composition for individual DIC species based on the measured total DIC C isotope composition in our experiments and DIC speciation from PHREEQC calculations. By extension, these alpha values are built into the determination of $^{13}C/^{12}C$ $10^3 \ln(\alpha_{calcite\text{-}HCO3})$ values reported in Table 2. The O isotope composition of DIC was not needed to calculate experimental $^{18}O/^{16}O$ 10^3 $\ln(\alpha_{calcite\text{-}H2O})$ values. The treatment of clumped isotopes in the model of Watkins and Hunt (2015) is based on an equilibrium Δ_{63} value of the Devil's Hole calcite and the temperature-dependent ^{13}C -^{18}O bonding determined for calcite, HCO_3^-, and CO_3^{2-} by Hill et al. (2014). However, calculated ^{13}C -^{18}O bonding for calcite DIC species may be underestimated based on a comparison between experimental calcite work and the Δ_{63}-T relation determined by Hill et al (2014). As a first order attempt to account for this, we have modified the clumped isotope component of the Watkins and Hunt (2015) model by applying a constant shift in Δ_{47} values toward more positive values according to the temperature-dependent difference for calcite between values predicted by the Hill et al. (2014) and Zaarur et al. (2013, Equation 7). The Zaarur et al. experimental study matches our data most closely. These adjustments are 0.113, 0.098, and 0.084‰ at *p*H = 6.6 and 10, 20, and 30ºC, respectively. This adjustment is not meant to be a rigorous correction for an exact comparison to our experimental results (Figures S7 – S9), rather, this shift has been included to assist in figure clarity.

It is worth noting that the modeled Δ_{47} values shift in a more positive direction when the surface speciation HCO_3^-:CO_3^{2-} ratio changes from 100 to 0.25 in the kinetically controlled or influenced regions of precipitation rate. This observation is related to the exclusion of ^{13}C and ^{18}O during kinetic fractionation at more rapid precipitation rates and a disproportionate change in the predicted solid carbonate stochastic ^{13}C -^{18}O bonding compared to pre-existing ^{13}C -^{18}O bonds inherited from DIC. This effect is analogous to the kinetic effects in DIC predicted by Guo (2008) and shown

experimentally by Affek and Zaarur (2014) during CO_2 degassing from solutions. The modeled ^{13}C -^{18}O bonding difference imparted by the surface speciation HCO_3^- : CO_3^{2-} ratio is slight. However, the fact that solution phase CO_3^{2-} is believed to have a lower Δ_{63} value than HCO_3^- but may impart a higher calcite Δ_{63} value compared to bicarbonate under certain conditions, all else being equal, implies that considering precipitation rate is critical when using clumped isotopes to investigate kinetic effects and helps support a precipitation mechanism that relies on CO_3^{2-} ions more than solution DIC speciation at circa neutral *p*H would suggest.

Also supporting our interpretation that CO_3^{2-} contributes more to calcite formation than HCO_3^- is the agreement between our data set and the model presented by Devriendt et al. (2017). This model is based on the kinetic reactions occurring between calcite, DIC, and H_2O to track O isotopes (but not C or clumped isotopes) as they precipitate from solution to form solid. A central tenet of the framework is that carbonate minerals form primarily from CO_3^{2-} ions but can be modified to allow for possible contribution from deprotonated HCO_3^- ions as well. Most parameters used to apply the model to our experiments are determined directly from measured solution chemistry values or other information provided in Table A1. However, the value of the partial reaction order and reactivity coefficient of HCO_3^- are less straightforward to ascertain. We use a value of 0.22 for the partial reaction order as in the low ionic strength cases explored by Devriendt et al. (2017). However, the fit between modeled fractionation and our observations decreases if larger partial reaction order values are considered. The final parameter of HCO_3^- reactivity was varied to find a range of values which agree with our dataset. The calculated calcite-water fractionation under our conditions is not sensitive to high values of HCO_3^- availability but requires a minimum contribution of 0.5 mol% HCO_3^- to reproduce the observed $10^3 \ln(\alpha_{calcite\text{-}H2O})$ values we report. Although the Watkins and Hunt (2015) and Devriendt et al. (2017) models are fundamentally unique, they both predict a relatively large contribution of CO_3^- to calcite formation based on our experimental data.

Saturation state is a first-order factor controlling carbonate precipitation rate. The experimental conditions utilized during our study do not include a wide enough range of saturation states to rigorously investigate a correlation between degree of saturation and ^{13}C -^{18}O bonding. To explore this parameter more broadly, however, we have compiled saturation state values from available data for the experimental data sets of Dennis and Schrag (2010), Tang et al. (2014), and Kelson et al. (2017). Starting saturation conditions were directly reported by Dennis and Schrag (2010) and used with the assumption that the starting saturation state was maximum at the initiation of the experiment and that the experiment shifted to exact saturation ($\Omega = 1$) by the end of the experiment. With this assumption, an average saturation for the experiment was calculated. A similar approach was taken for experiments of Kelson et al. (2017) with incomplete experimental condition details. Specifically, a few of the values in the experimental condition tables were missing. In these cases, a minimum saturation state of $\Omega = 1$ was assumed where both starting and ending *p*H or reagent concentrations

were not available for saturation state calculations, but it should be noted this may be far from the actual conditions. Saturation states for Kelson et al. (2017) experiments were calculated with PHREEQC software (Parkhurst and Appelo, 2013) and phreeqc.dat database. "Critical saturation indices" for Tang et al. (2014) experiments were indirectly reported in the publication of Tang et al. (2008). These values are assumed to be representative of most solid carbonate formation during the experiments reported by Tang et al. (2014) and have been converted to saturation state with no modification.

Temperatures used in the above studies include a wide variety of individual values. In order to make as direct a comparison as possible, the $10^3 \ln(\alpha_{calcite\text{-}H2O})$ and Δ_{47} values reported by Dietzel et al. (2009), Dennis and Schrag (2010), Tang et al. (2014), and Kelson et al. (2017) have been adjusted to correspond to temperatures explored in this study (Figures 5, 8-10, S5, S6, S11-S13). The work of Dietzel et al. (2009) and Tang et al. (2014) concern the same experiments but the former publication considers O isotopes and the latter publication focuses on clumped isotopes. For all four studies, individual experimental values in the range of 0-14°C, 15-24°C, and 25-40°C have been converted to 10°C, 20°C, and 30°C, respectively. These adjustments have been made according to the Δ_{47}-T or $10^3 \ln(\alpha_{calcite\text{-}H2O})$-T relations determined in each respective study and retain data set variability for each set of conditions. For example, Tang et al. (2014) report a Δ_{47}-T relation in their data of $\Delta_{47}(ARF) = (0.0387 \pm 0.0072) \times 10^6 T^{-2} + (0.2532 \pm 0.0829)$ which implies a Δ_{47} difference of -0.0175‰ between 5 and 10°C. This constant offset has been applied to all 5°C experiments of Tang et al. (2014) while adjustments of +0.0150‰ and +0.0265‰ have been applied to 25 and 40°C experiments, respectively. Similarly, most data points from the studies of Dennis and Schrag (2010) and Kelson et al. (2017) in the range of 0 to 40°C have been shifted to represent temperatures of 10°C, 20°C, and 30°C. Additionally, Devils Hole calcite values as reported by Kluge et al. (2014) has been considered with the 30°C data. The adjustment from 33.7 to 30°C utilized the Δ_{47}-T and $10^3 \ln(\alpha_{calcite\text{-}H2O})$-T calibrations of Zaarur et al. (2013).

Exceptions to the datasets described in the preceding paragraph include the following: Following the discussion in Tang et al. (2014), we have excluded experiments performed at *p*H values above 9.0 in our considerations. Also, although Dietzel et al. (2009) report 17 experiments at 40°C, the work of Tang et al. (2014) only considers 7 of those experiments. We have included only the latter 7 experiments in our O isotope fractionation comparison. To limit our cross-study comparison to experimental approaches and conditions which are as similar as possible, we have only considered experiments by Kelson et al. (2017) which utilized "passive degassing" and "mixed solution" experiments. These two methods were also used by Dennis and Schrag (2010). Finally, some experimental details were undetermined or omitted from the publication of Kelson et al. (2017) which prevented the calculation of saturation state and/or $10^3 \ln(\alpha_{calcite\text{-}H2O})$ values and such data sets (including all "filtered" experiments) are therefore not discussed here.

CO_2 Mixing Calculation Example (Matlab Format)

```
% The following is an example of overgrowth D47 for calcite grown on
% calcite seed crystals of known isotope composition and clumping.
% This example is based on measured values which apply to UWAI-002. This
% script was developed after the "numerical demonstration of how to calculate
% D47, D48, and D49 from mass spectrometer data" provided by
% Huntington et al. (2009) in the supplemental information.
% Non-linear D47 mixing calculations following Affek and Eiler (2006).

%%%%%%%%%%%%%%%%%%
% Measured Values                 %
%%%%%%%%%%%%%%%%%%

Cs = 0.0799;       % grams of seed crystal used
Co = 0.1785;       % grams of overgrowth

% total (seed + overgrowth) gas values
d13t = 0.9688;     % d13C_PDB isotope composition
d18t = 30.2633;    % d18O_SMOW isotope composition
D47t = 0.6426;     % D47 value of CO2 gas in preferred reference frame

% seed crystal gas values
d13s = 4.3560;     % d13C_PDB isotope composition
d18s = 31.8090;    % d18O_SMOW isotope composition
D47s = 0.631;      % D47 value of CO2 gas in preferred reference frame

% reference/working gas values
RefGasd13 = -3.56; % dC13_PDB
RefGasd18 = 25.01; % d18O_SMOW

% Constants
OrigPDBCO2_R13 = 0.0118;     % "Brand Values" from Daeron et al. (2016)
VSMOW_R18 = 0.0020052;       % "Brand Values" from Daeron et al. (2016)
VSMOW_R17 = 0.00038475;      % "Brand Values" from Daeron et al. (2016)
VPDBcalcite_R13 = OrigPDBCO2_R13;
lambda = 0.528;                % "Brand Values" from Daeron et al. (2016)
VPDBCO2_R13 = VPDBcalcite_R13;
VPDBCO2_R18 = 0.00208839;    % "Brand Values" from Daeron et al. (2016)
VPDBCO2_R17 = 0.00039310;    % "Brand Values" from Daeron et al. (2016)


%%%%%%%%%%%%%%%%%%%%%%%%%%
% Scramble reference gas          %
```

```
%%%%%%%%%%%%%%%%%%%%%%%%%
% REF GAS: calculate R13, R17, R18
% minimum value of (R13+2R18-R45)^2+(2R18+2R13R17+(R17)^2-R46)^2

RefGasd13; % defined above
RefGasd18; % defined above
RefGasR13 =((RefGasd13/1000)+1)*VPDBCO2_R13;
RefGasR18 =((RefGasd18/1000)+1)*VSMOW_R18;
RefGasR17 =((RefGasR18/VSMOW_R18)^lambda)*VSMOW_R17;

% REF GAS: calculate abundance of isotopes, assuming stochastic
% distribution of isotopes among isotopologues

RefGas12C =1/(1+RefGasR13); % [12C]=1/(1+R13)
RefGas13C = 1- RefGas12C; % [13C]=R13/(1+R13)
RefGas16O =1/(1+RefGasR17+RefGasR18); % [16O]=1/(1+R17+R18)
RefGas17O = RefGasR17*RefGas16O; % [17O]=R17/(1+R17+R18)
RefGas18O = RefGasR18*RefGas16O; % [18O]=R18/(1+R17+R18)

% REF GAS: calculate randomly distributed abundance of CO2
% [44]* = [12][16][16]
% [45]* = [13][16][16]+2[12][16][17]
% [46]* = 2[12][16][18]+[12][17][17]+2[13][16][17]
% [47]* = 2[13][16][18]+[13][17][17]+2[12][17][18]

RefGas121616 = RefGas12C*RefGas16O*RefGas16O;
RefGas121617 = RefGas12C*2*RefGas16O*RefGas17O;
RefGas131616 = RefGas13C*RefGas16O*RefGas16O;
RefGas121618 = RefGas12C*2*RefGas16O*RefGas18O;
RefGas121717 = RefGas12C*RefGas17O*RefGas17O;
RefGas131716 = RefGas13C*2*RefGas17O*RefGas16O;
RefGas121718 = RefGas12C*2*RefGas17O*RefGas18O;
RefGas131618 = RefGas13C*2*RefGas16O*RefGas18O;
RefGas131717 = RefGas13C*RefGas17O*RefGas17O;
RefGas121818 = RefGas12C*RefGas18O*RefGas18O;
RefGas131718 = RefGas13C*2*RefGas17O*RefGas18O;
RefGas131818 = RefGas13C*RefGas18O*RefGas18O;

RefGas44 = RefGas121616;
RefGas45 = RefGas121617 + RefGas131616;
RefGas46 = RefGas121618 + RefGas121717 + RefGas131716;
RefGas47 = RefGas121718 + RefGas131618 + RefGas131717;
RefGas48 = RefGas121818 + RefGas131718;
RefGas49 = RefGas131818;
```

```
% REF GAS: calculate ratios by dividing abundance by [44]*

RefGasR45 = RefGas45/RefGas44;
RefGasR46 = RefGas46/RefGas44;
RefGasR47 = RefGas47/RefGas44;
RefGasR48 = RefGas48/RefGas44; % not used in calculations below
RefGasR49 = RefGas49/RefGas44; % not used in calculations below

%%%%%%%%%%%%%%%%%%%%%%%%%
% Scramble seed gas                    %
%%%%%%%%%%%%%%%%%%%%%%%%%
% seed GAS: calculate R13, R17, R18

sGasd13 = d13s; % defined above
sGasd18 = d18s; % defined above
sGasR13 = ((sGasd13/1000)+1)*VPDBCO2_R13;
sGasR18 = ((sGasd18/1000)+1)*VSMOW_R18;
sGasR17 = ((sGasR18/VSMOW_R18)^lambda)*VSMOW_R17;

% seed GAS: calculate abundance of isotopes, assuming stochastic
% distribution of isotopes among isotopologues

sGas12C = 1/(1+sGasR13);% [12C]=1/(1+R13)
sGas13C = 1- sGas12C; % [13C]=R13/(1+R13)
sGas16O = 1/(1+sGasR17+sGasR18);  % [16O]=1/(1+R17+R18)
sGas17O = sGasR17*sGas16O; % [17O]=R17/(1+R17+R18)
sGas18O = sGasR18*sGas16O;   % [18O]=R18/(1+R17+R18)

% seed GAS: calculate randomly distributed abundance of CO2
% [44]* = [12][16][16]
% [45]* = [13][16][16]+2[12][16][17]
% [46]* = 2[12][16][18]+[12][17][17]+2[13][16][17]
% [47]* = 2[13][16][18]+[13][17][17]+2[12][17][18]

sGas121616 = sGas12C*sGas16O*sGas16O;
sGas121617 = sGas12C*2*sGas16O*sGas17O;
sGas131616 = sGas13C*sGas16O*sGas16O;
sGas121618 = sGas12C*2*sGas16O*sGas18O;
sGas121717 = sGas12C*sGas17O*sGas17O;
sGas131716 = sGas13C*2*sGas17O*sGas16O;
sGas121718 = sGas12C*2*sGas17O*sGas18O;
sGas131618 = sGas13C*2*sGas16O*sGas18O;
sGas131717 = sGas13C*sGas17O*sGas17O;
```

```
sGas121818 = sGas12C*sGas18O*sGas18O;
sGas131718 = sGas13C*2*sGas17O*sGas18O;
sGas131818 = sGas13C*sGas18O*sGas18O;

sGas44 = sGas121616;
sGas45 = sGas121617 + sGas131616;
sGas46 = sGas121618 + sGas121717 + sGas131716;
sGas47 = sGas121718 + sGas131618 + sGas131717;
sGas48 = sGas121818 + sGas131718;
sGas49 = sGas131818;

% seed GAS: calculate ratios by dividing abundance by [44]*

sGasR45 = sGas45/sGas44; % not used in calculations below
sGasR46 = sGas46/sGas44; % not used in calculations below
sGasR47 = sGas47/sGas44;
sGasR48 = sGas48/sGas44; % not used in calculations below
sGasR49 = sGas49/sGas44; % not used in calculations below


%%%%%%%%%%%%%%%%%%%%%%%%%
% Scramble total gas                    %
%%%%%%%%%%%%%%%%%%%%%%%%%
% total (seed + overgrowth) GAS: calculate R13, R17, R18

tGasd13 = d13t; % defined above
tGasd18 = d18t; % defined above
tGasR13 =((tGasd13/1000)+1)*VPDBCO2_R13;
tGasR18 =((tGasd18/1000)+1)*VSMOW_R18;
tGasR17 =((tGasR18/VSMOW_R18)^lambda)*VSMOW_R17;

% total GAS: calculate abundance of isotopes,
% assuming stochastic distribution of isotopes among isotopologues

tGas12C =1/(1+tGasR13);
tGas13C = 1- tGas12C;
tGas16O =1/(1+tGasR17+tGasR18);
tGas17O = tGasR17*tGas16O;
tGas18O = tGasR18*tGas16O;

% total GAS: calculate randomly distributed abundance of CO2
% [44]* = [12][16][16]
% [45]* = [13][16][16]+2[12][16][17]
% [46]* = 2[12][16][18]+[12][17][17]+2[13][16][17]
```

```
% [47]* = 2[13][16][18]+[13][17][17]+2[12][17][18]

tGas121616 = tGas12C*tGas16O*tGas16O;
tGas121617 = tGas12C*2*tGas16O*tGas17O;
tGas131616 = tGas13C*tGas16O*tGas16O;
tGas121618 = tGas12C*2*tGas16O*tGas18O;
tGas121717 = tGas12C*tGas17O*tGas17O;
tGas131716 = tGas13C*2*tGas17O*tGas16O;
tGas121718 = tGas12C*2*tGas17O*tGas18O;
tGas131618 = tGas13C*2*tGas16O*tGas18O;
tGas131717 = tGas13C*tGas17O*tGas17O;
tGas121818 = tGas12C*tGas18O*tGas18O;
tGas131718 = tGas13C*2*tGas17O*tGas18O;
tGas131818 = tGas13C*tGas18O*tGas18O;

tGas44 = tGas121616;
tGas45 = tGas121617 + tGas131616;
tGas46 = tGas121618 + tGas121717 + tGas131716;
tGas47 = tGas121718 + tGas131618 + tGas131717;
tGas48 = tGas121818 + tGas131718;
tGas49 = tGas131818;

% total GAS: calculate ratios by dividing abundance by [44]*

tGasR45 = tGas45/tGas44; % not used in calculations below
tGasR46 = tGas46/tGas44; % not used in calculations below
tGasR47 = tGas47/tGas44;
tGasR48 = tGas48/tGas44; % not used in calculations below
tGasR49 = tGas49/tGas44; % not used in calculations below


%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% Mixing Model Calculations                 %
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

% R45, R46, R47 expressions are also given by
% Affek and Eiler (2006) Appendix A equations (A2)

Ct = Cs + Co; % total calcite mass
f = Cs/Ct;    % fraction of seed mass to total mass

R13s = ((d13s/1000)+1)*VPDBcalcite_R13;  % mass 13 ratio for seeds
R18s = ((d18s/1000)+1)*VSMOW_R18;       % mass 18 ratio for seeds
R17s = VSMOW_R17*(R18s/VSMOW_R18)^lambda;
```

```
R45s = R13s + 2*R17s;                % Eqn from Santrock et al. (1985)
d45s = (R45s/RefGasR45-1)*1000;
R46s = 2*R18s + 2*R13s*R17s + (R17s)^2;  % Eqn from Santrock et al. (1985)
d46s = (R46s/RefGasR46-1)*1000;
R47s = ((D47s/1000)+1)*sGasR47;        % mass 47 ratio for seeds
d47s = (R47s/RefGasR47-1)*1000;

R13t = ((d13t/1000)+1)*VPDBcalcite_R13;  % mass 13 ratio for total
R18t = ((d18t/1000)+1)*VSMOW_R18;       % mass 18 ratio for total
R17t = VSMOW_R17*(R18t/VSMOW_R18)^lambda;
R45t = R13t + 2*R17t;                          % Eqn from Santrock et al. (1985)
d45t = (R45t/RefGasR45-1)*1000;
R46t = 2*R18t + 2*R13t*R17t + (R17t)^2;  % Eqn from Santrock et al. (1985)
d46t = (R46t/RefGasR46-1)*1000;
R47t = ((D47t/1000)+1)*tGasR47;                % mass 47 ratio for seeds
d47t = (R47t/RefGasR47-1)*1000;

% The following equations are derived from
% Affek and Eiler (2006) Appendix A equations (A6)

R13o = (R13t-f*R13s)/(1-f); % mass 13 ratio for overgrowth gas
R17o = (R17t-f*R17s)/(1-f); % mass 17 ratio for overgrowth gas
R18o = (R18t-f*R18s)/(1-f); % mass 18 ratio for overgrowth gas
R45o = (R45t-f*R45s)/(1-f); % mass 45 ratio for overgrowth gas
R46o = (R46t-f*R46s)/(1-f); % mass 46 ratio for overgrowth gas
R47o = (R47t-f*R47s)/(1-f); % mass 47 ratio for overgrowth gas


%%%%%%%%%%%%%%%%%%%%
% Overgrowth Values                %
%%%%%%%%%%%%%%%%%%%%

d13o = (d13t-f*d13s)/(1-f); % linear mixing
d18o = (d18t-f*d18s)/(1-f); % linear mixing
d47o = (d47t-f*d47s)/(1-f); % linear mixing

% Non-linear mixing equation (A7) from
% Affek and Eiler (2006) Appendix A
D47o = (R47o/(2*R13o*R18o+2*R17o*R18o+R13o*(R17o^2))...
   -R46o/(2*R18o+2*R13o*R17o+(R17o)^2)...
   -R45o/(R13o+2*R17o)+1)*1000
```

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Wolthers, M., Nehrke, G., Gustafsson, J.P., & Cappellen, P.V. (**2012**) Calcite growth kinetics: Modeling the effect of solution stoichiometry. *Geochim. Cosmochim. Acta*, 77, 121-134.

Zaarur, S., Affek, H.P., & Brandon, M.T. (**2013**) A revised calibration of the clumped isotope thermometer. *Earth and Planetary Science Reviews*, 382, 47-57.

Supporting Figures Section

Figures S3-S4 and S5-S6 are equivalent to Figures 2 and 5 in the main text, respectively, but at different temperatures.

Figure S1. Scanning electron microscopy imagery of calcite seed crystals. Main Figure: A 3.8 mm by 1.76 mm mosaic image of calcite seed crystals deposited on an adhesive surface. The scale bar at the bottom of the image is 100 µm. Inset: Typical grain size and crystal habit.

Figure S2. X-ray diffraction patterns for experimental products and calcite seed crystals. These analyses confirm calcite was the sole mineral product.

Figure S3. Reproduction of the semi-empirical ion-by-ion growth model of Watkins and Hunt (2015) for calcite growth under kinetic and (assumed) C equilibrium conditions. The model is based on a "kinetic" regime from the experiments of Romanek et al. (1992, shown by green triangle symbols for 10°C) and inferred equilibrium from Coplen (2007). The orange dashed line is modeled fractionation for 10°C, *p*H = 6.6, and a surface HCO_3^-:CO_3^{2-} ratio (Θ) of 100. The purple dotted line is modeled fractionation for 10°C, *p*H = 6.6, and a surface HCO_3^-:CO_3^{2-} ratio (Θ) of 0.25. Also included are values found during this study at 10°C for partitioning between calcite and aqueous carbonate (red squares).

Figure S4. As in Figure S3 but for 30°C modeled values and 25°C values for Romanek et al. (1992).

Figure S5. Reproduction of the semi-empirical ion-by-ion growth model of Watkins and Hunt (2015) for calcite growth under kinetic and (assumed) O equilibrium conditions. The model is based on a "kinetic" regime from the experiments of Watkins et al. (2014) and inferred equilibrium from Bottinga (1968) and Coplen (2007). The orange dashed line is modeled fractionation for 10°C, *p*H = 6.6, and a surface HCO_3^-:CO_3^{2-} ratio (Θ) of 100. The purple dotted line is modeled fractionation for 10°C, *p*H = 6.6, and a surface HCO_3^-:CO_3^{2-} ratio (Θ) of 0.25. Also included are red squares values found during this study at 10°C for partitioning between calcite and aqueous carbonate (red squares). Finally, the adjusted experimental values (T = 10°C, *p*H = 8.3 to 9.0) of Dietzel et al. (2009) are indicated by yellow diamonds.

Figure S6. As in Figure S5 but for 30°C modeled values. Green circle symbols indicate experimental values of Watkins et al. (2014). The green double line represents modeled values at 25°C, *p*H = 8.3, and a surface HCO_3^-:CO_3^{2-} ratio (Θ) of 2.

Figure S7. Reproduction of the semi-empirical ion-by-ion growth model of Watkins and Hunt (2015) for calcite growth under kinetic and (assumed) clumped equilibrium conditions. The model is based on a "kinetic" regime from the work of Hill et al. (2014), inferred equilibrium from Kluge et al. (2014), and adjusted to account for the difference in calcite Δ_{47} between Hill et al. (2014) and Zaarur et al. (2013). The orange dashed line is modeled clumping for 10°C, *p*H = 6.6, and a surface HCO_3^-:CO_3^{2-} ratio (Θ) of 100. The purple dotted line is modeled clumping for 10°C, *p*H = 6.6, and a surface HCO_3^-:CO_3^{2-} ratio (Θ) of 0.25. Also included are values found during this study at 10°C (red squares). Finally, the work of Tang et al. (2014) is represented by peach-colored diamonds. These values are associated with experimental temperatures of 5°C (*p*H = 8.3 to 9.0), but have been adjusted to 10°C in the figure according to the Δ_{47}-T relation reported by Tang et al. (2014).

Figure S8. As in Figure S7 but for 20°C.

Figure S9. As in Figure S7 but for 30°C.

Figure S10. Experimental Δ_{47} plotted against O isotope fractionation between overgrowth calcite and water. Per Tripati et al. (2015), a correlation between these two values (at a given temperature) can indicate disequilibrium due to kinetic effects.

Figure S11. Comparison of four studies and experimental O isotope fractionation between calcite and water as a function of solution saturation state with respect to calcite. All experimental values represent average experiment conditions and have been adjusted to represent $10^3 \ln(\alpha_{calcite\text{-}H2O})$ at 10°C (See Supporting Information for adjustment description). Error bars for data points from this study represent maximum and minimum saturation based on measured solution conditions. Error bars for the data points of Kelson et al. (2017) and Dennis and Schrag (2010) represent maximum saturation based on reported solution conditions or saturation states. In cases where both starting and ending solution conditions were not reported, an assumed minimum (end of experiment) saturation state of Ω = 1 was assumed. The saturation states of Dietzel et al. (2009) were used as reported in Tang et al. (2008). The vertical dotted line represents saturation (equilibrium, Ω = 1). The temperatures indicated on the second vertical axis are based on the work of Zaarur et al. (2013).

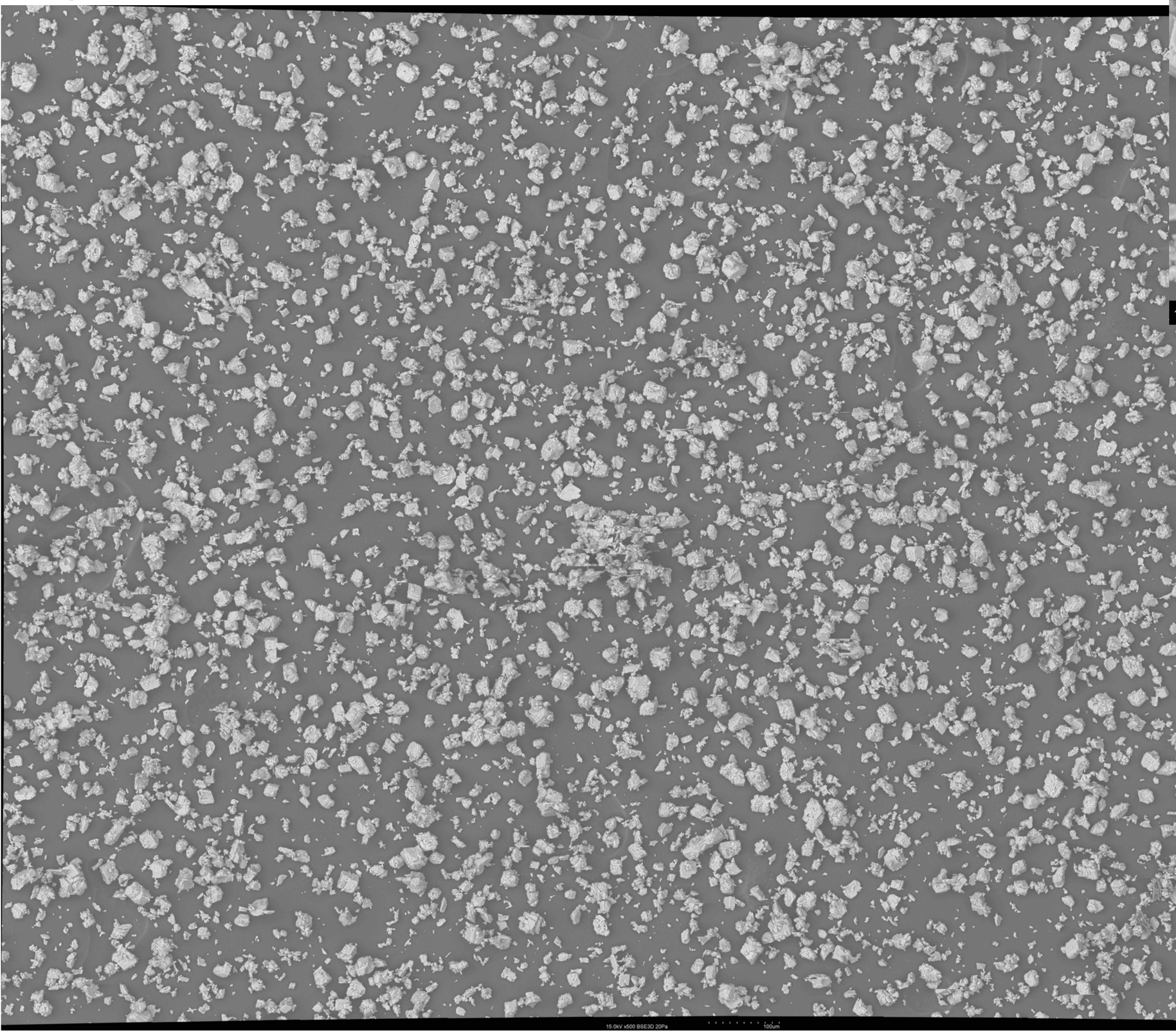
Figure S12. As in Figure S11 but for 20°C.

Figure S13. As in Figure S11 but for 30°C.

Figure S14. Clumped isotope composition of experimental calcite as a function of temperature. Blue circles indicate values determined by "Santrock" ^{17}O correction parameters and red squares indicate values re-processed with "Brand" ^{17}O correction values according to Daeron et al. (2016). Error envelopes represent error weighted 95% confidence intervals.

Figure S1

Inset Figure



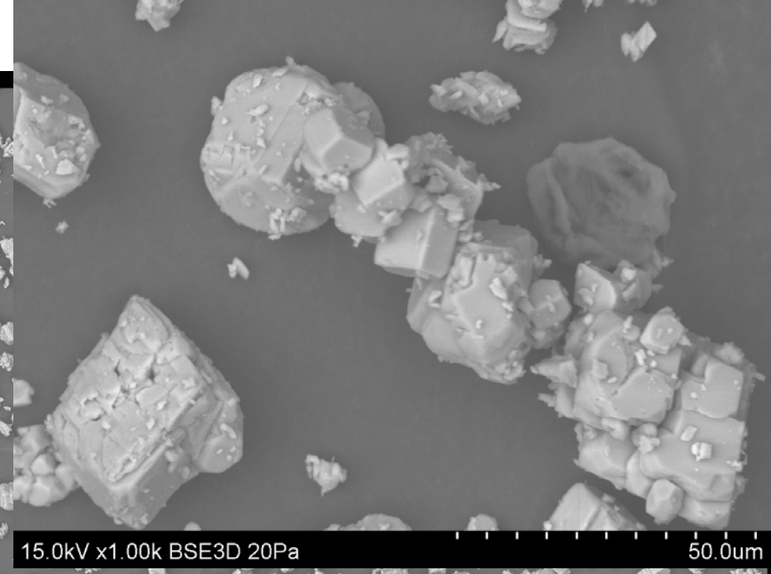


Figure S2
Seed & Product Diffraction Patterns

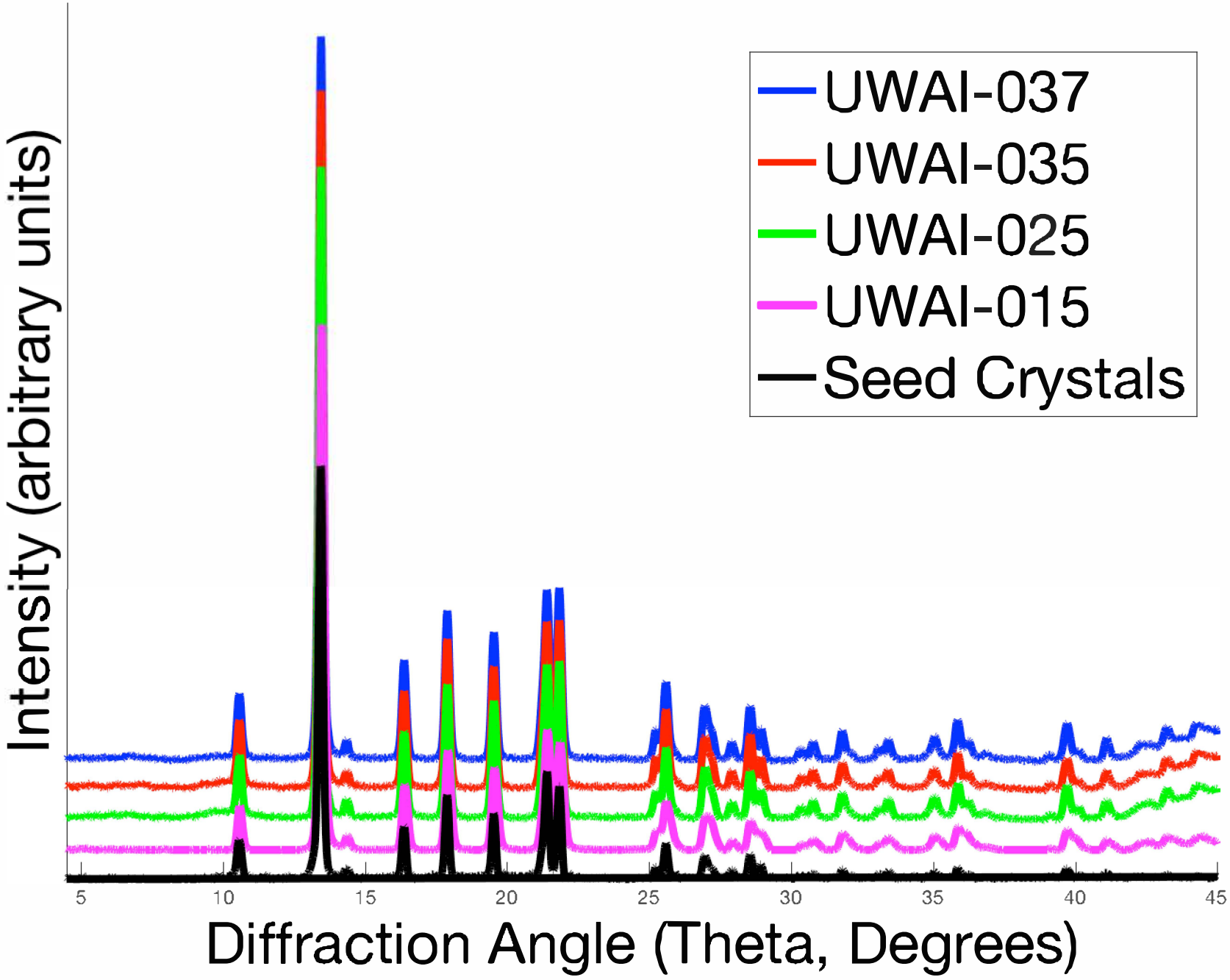


Figure S3

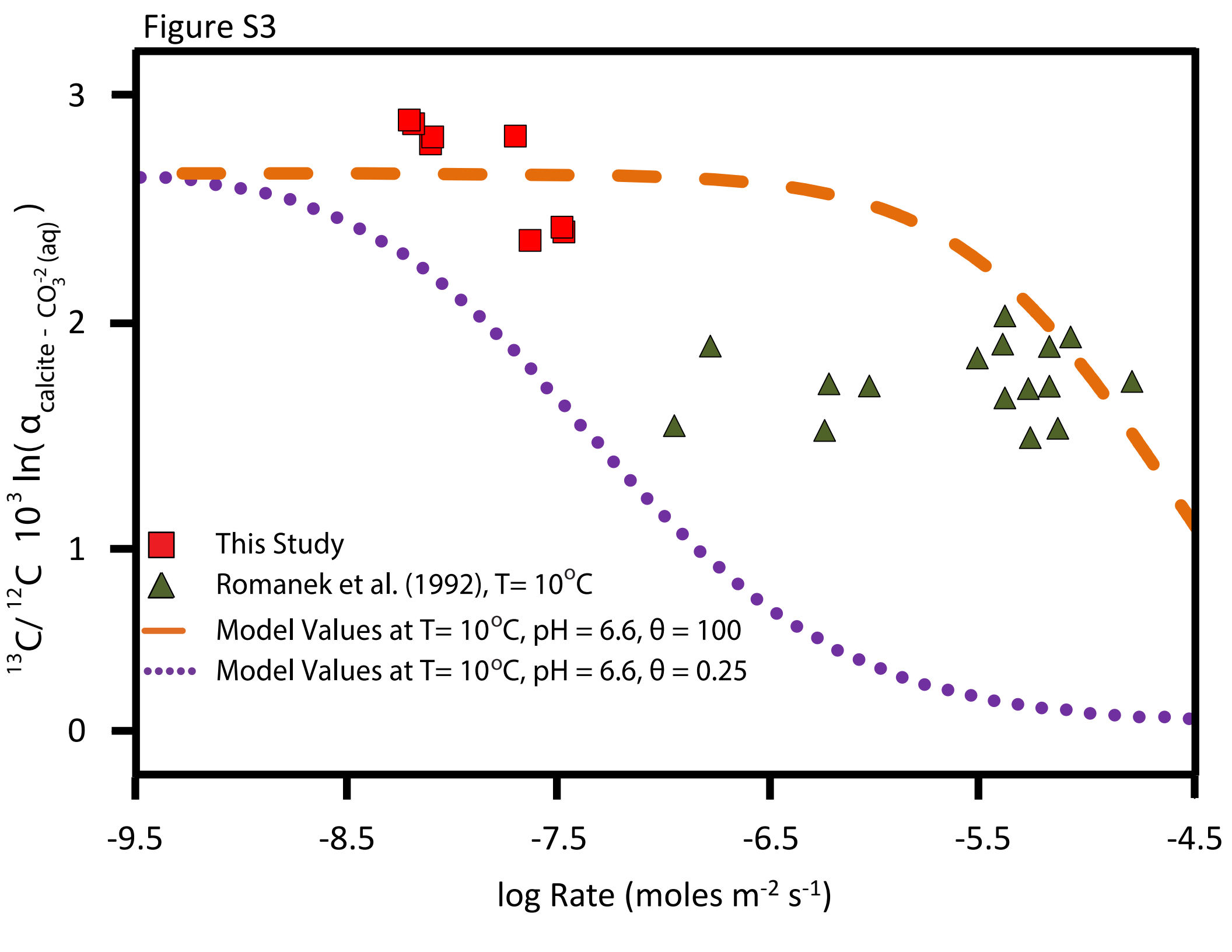

3
2
1
0
$^{13}C/^{12}C\ 10^3\ \ln(\alpha_{calcite - CO_3^{-2}(aq)})$
This Study
Romanek et al. (1992), T= 10°C
Model Values at T= 10°C, pH = 6.6, θ = 100
Model Values at T= 10°C, pH = 6.6, θ = 0.25
-9.5
-8.5
-7.5
-6.5
-5.5
-4.5
log Rate (moles $m^{-2}\ s^{-1}$)

Figure S4

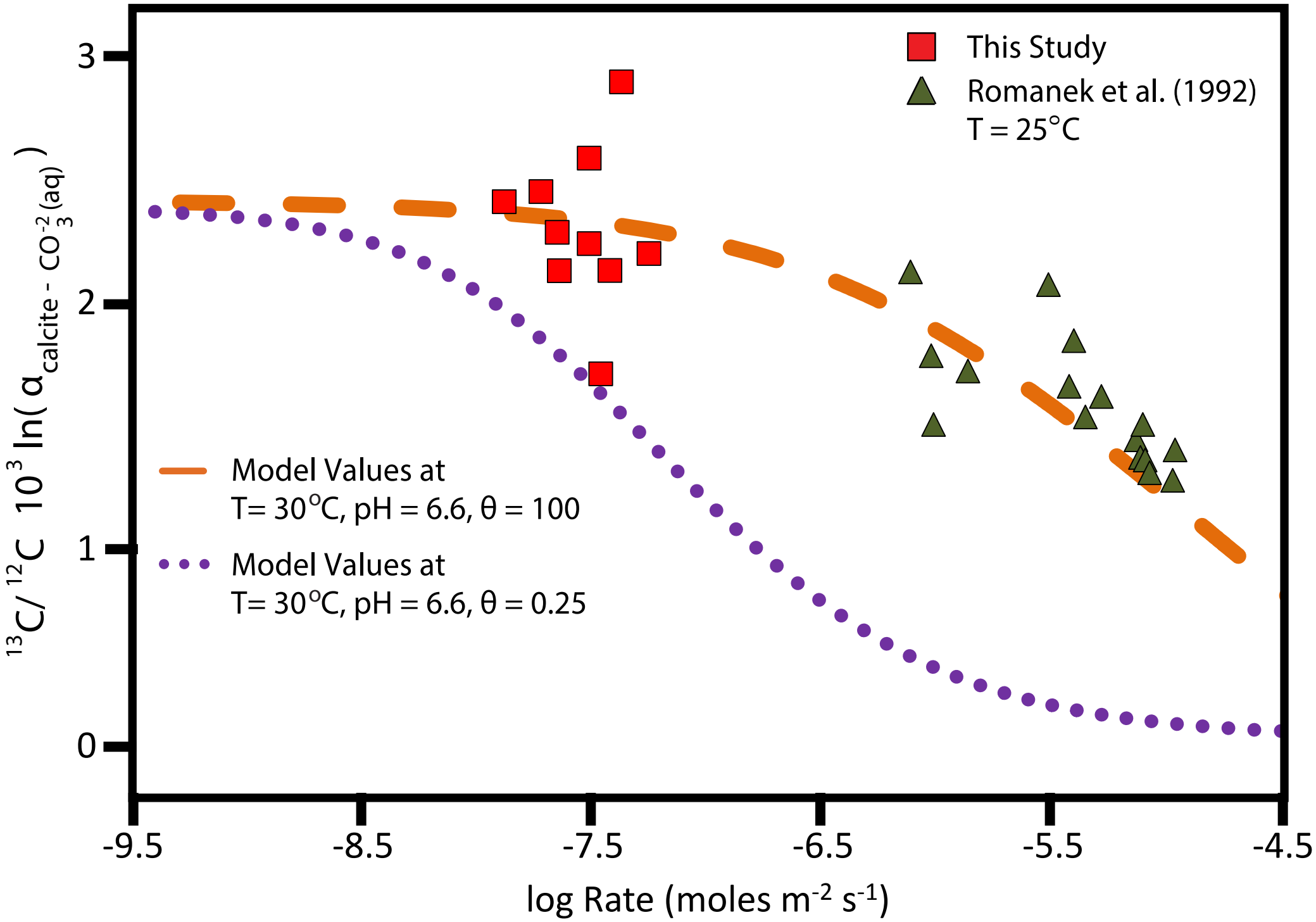

This Study
Romanek et al. (1992)
T = 25°C
Model Values at
T= 30°C, pH = 6.6, θ = 100
Model Values at
T= 30°C, pH = 6.6, θ = 0.25
$^{13}C/^{12}C\ 10^3 \ln(\alpha_{calcite - CO_3^{-2}(aq)})$
log Rate (moles m^{-2} s^{-1})
3
2
1
0
-9.5
-8.5
-7.5
-6.5
-5.5
-4.5

Figure S5

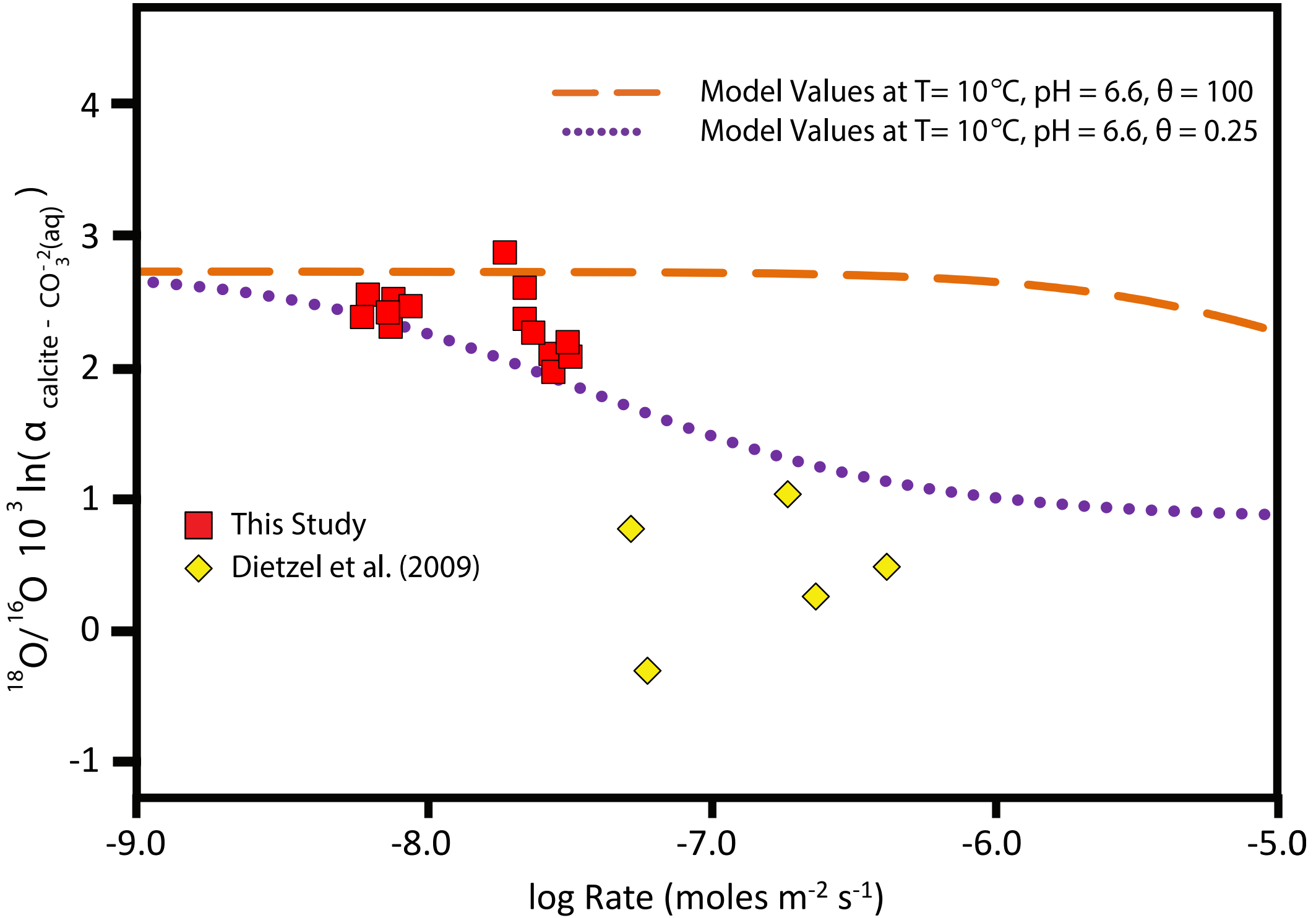
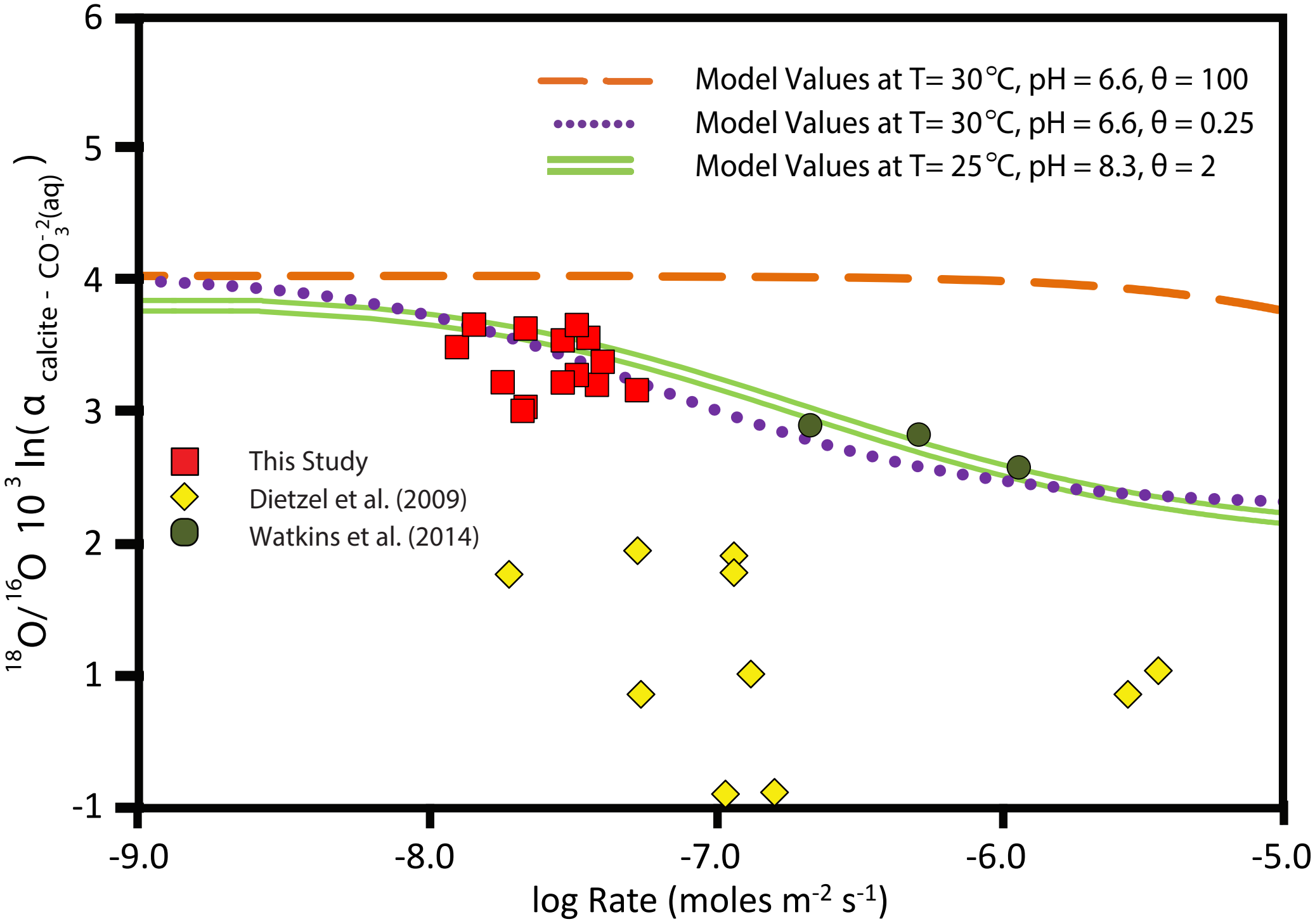
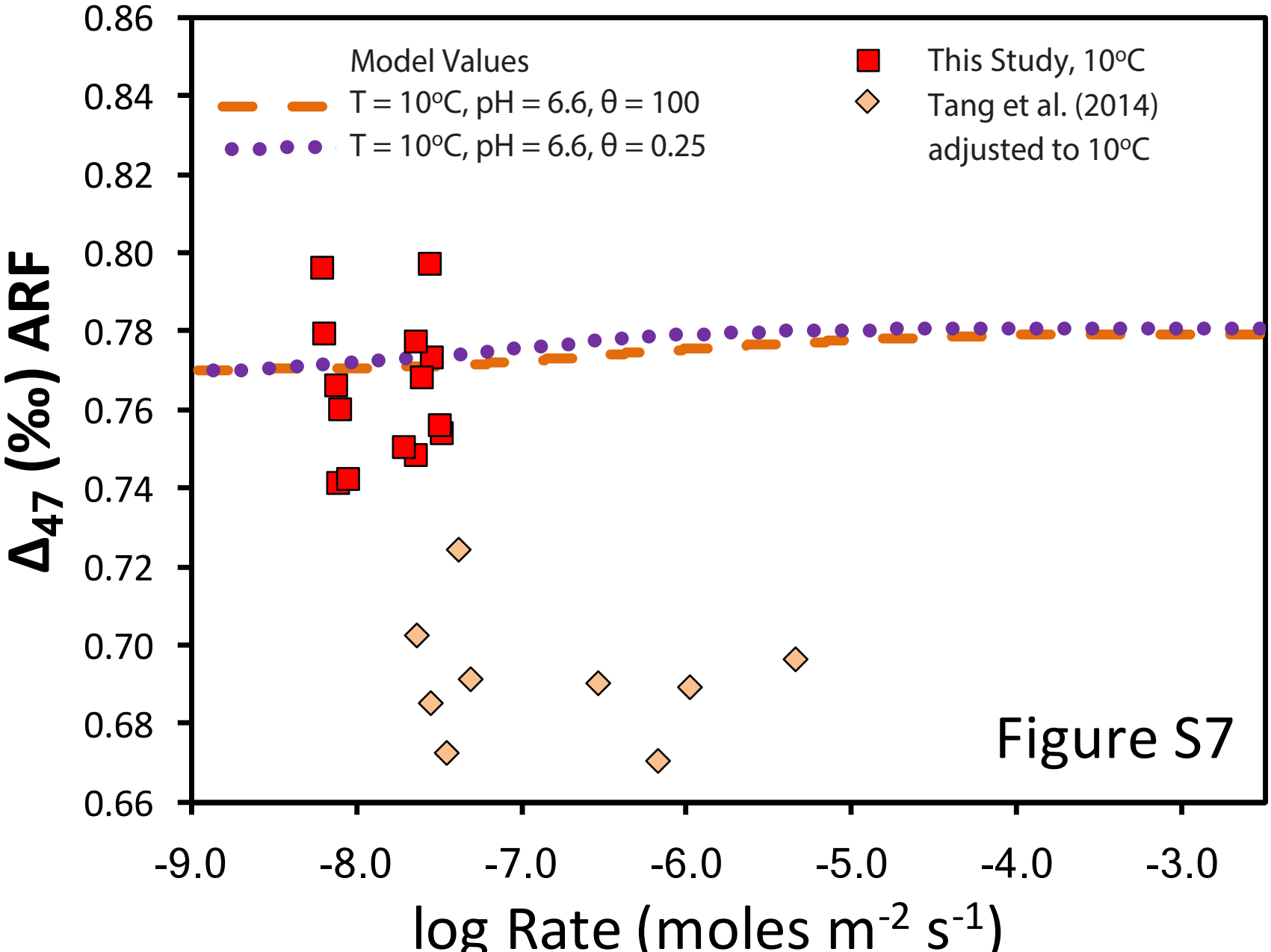

Model Values at T= 10°C, pH = 6.6, θ = 100
Model Values at T= 10°C, pH = 6.6, θ = 0.25
This Study
Dietzel et al. (2009)
$^{18}O/^{16}O\ 10^3 \ln(\alpha_{calcite - CO_3^{-2}(aq)})$
log Rate (moles m^{-2} s^{-1})
4
3
2
1
0
-1
-9.0
-8.0
-7.0
-6.0
-5.0

Figure S6


Model Values at T= 30 °C, pH = 6.6, θ = 100
Model Values at T= 30 °C, pH = 6.6, θ = 0.25
Model Values at T= 25 °C, pH = 8.3, θ = 2
This Study
Dietzel et al. (2009)
Watkins et al. (2014)
$^{18}O/^{16}O\ 10^3 \ln(\alpha_{calcite - CO_3^{-2}(aq)})$
log Rate (moles m^{-2} s^{-1})
6
5
4
3
2
1
-1
-9.0
-8.0
-7.0
-6.0
-5.0


Model Values
T = 10°C, pH = 6.6, θ = 100
T = 10°C, pH = 6.6, θ = 0.25
This Study, 10°C
Tang et al. (2014) adjusted to 10°C
Figure S7
Δ47 (‰) ARF
log Rate (moles m-2 s-1)
0.86
0.84
0.82
0.80
0.78
0.76
0.74
0.72
0.70
0.68
0.66
-9.0
-8.0
-7.0
-6.0
-5.0
-4.0
-3.0

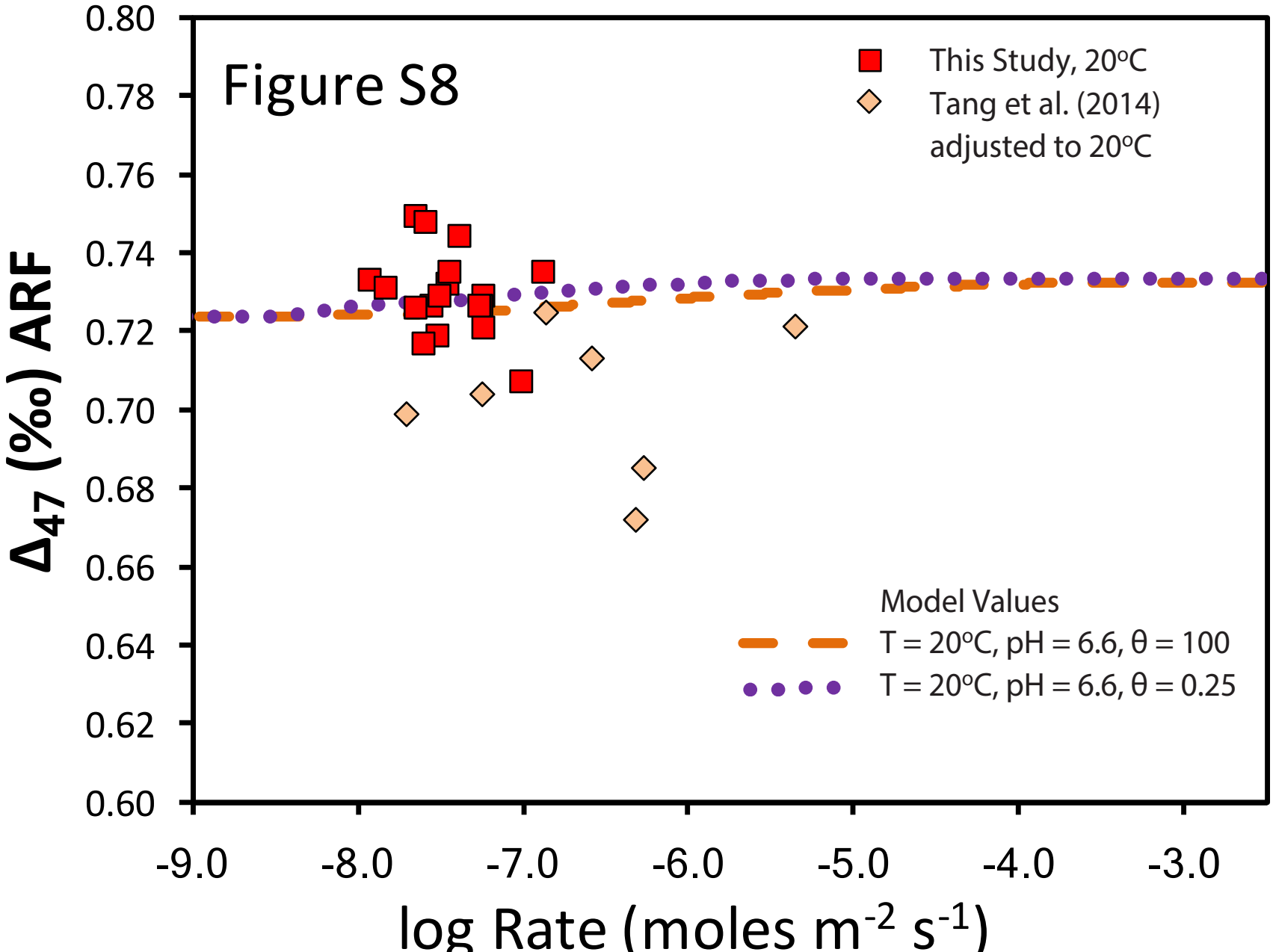


Figure S8
This Study, 20°C
Tang et al. (2014) adjusted to 20°C
Model Values
T = 20°C, pH = 6.6, θ = 100
T = 20°C, pH = 6.6, θ = 0.25
Δ47 (‰) ARF
0.80
0.78
0.76
0.74
0.72
0.70
0.68
0.66
0.64
0.62
0.60
-9.0
-8.0
-7.0
-6.0
-5.0
-4.0
-3.0
log Rate (moles m-2 s-1)

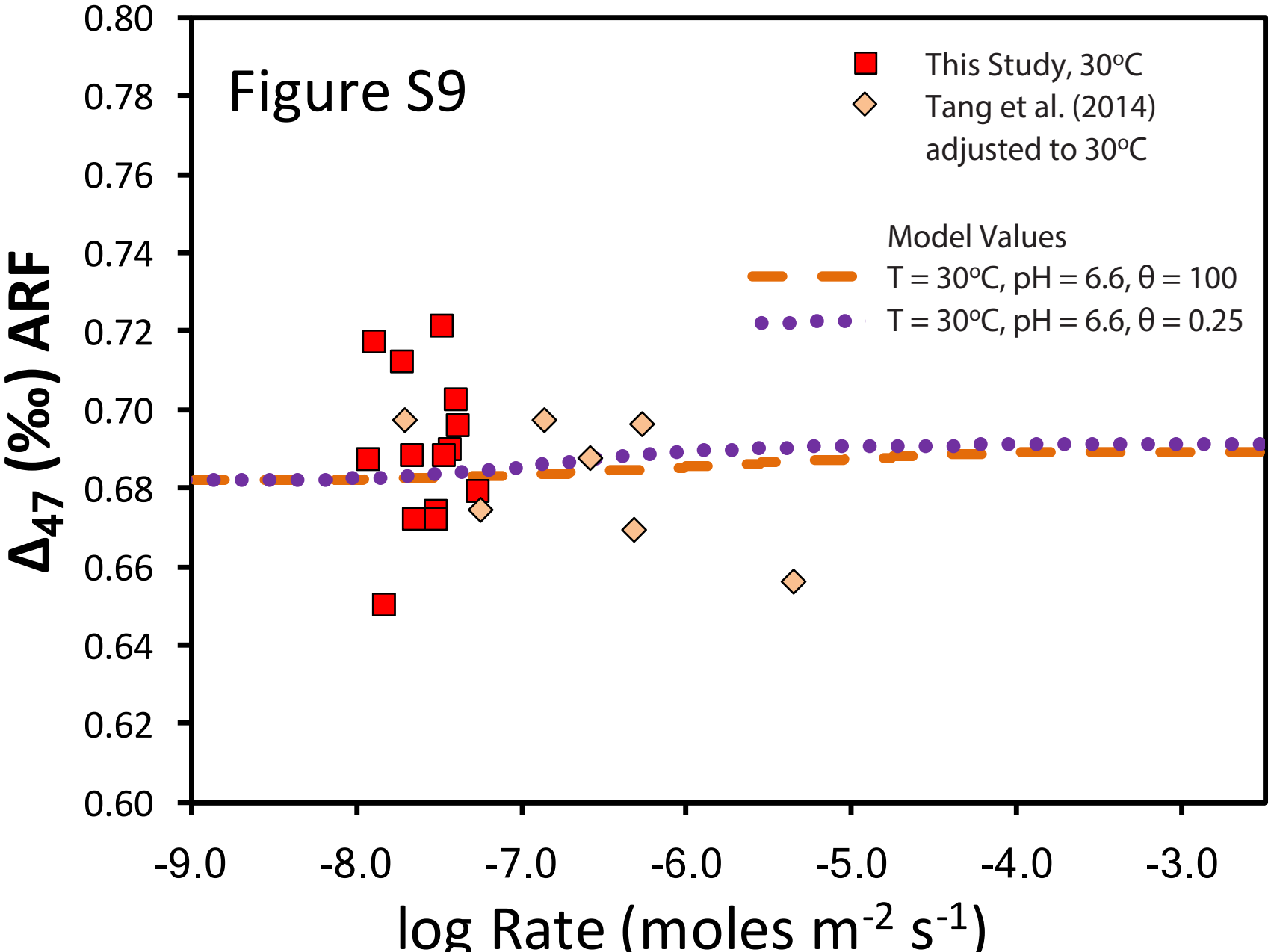
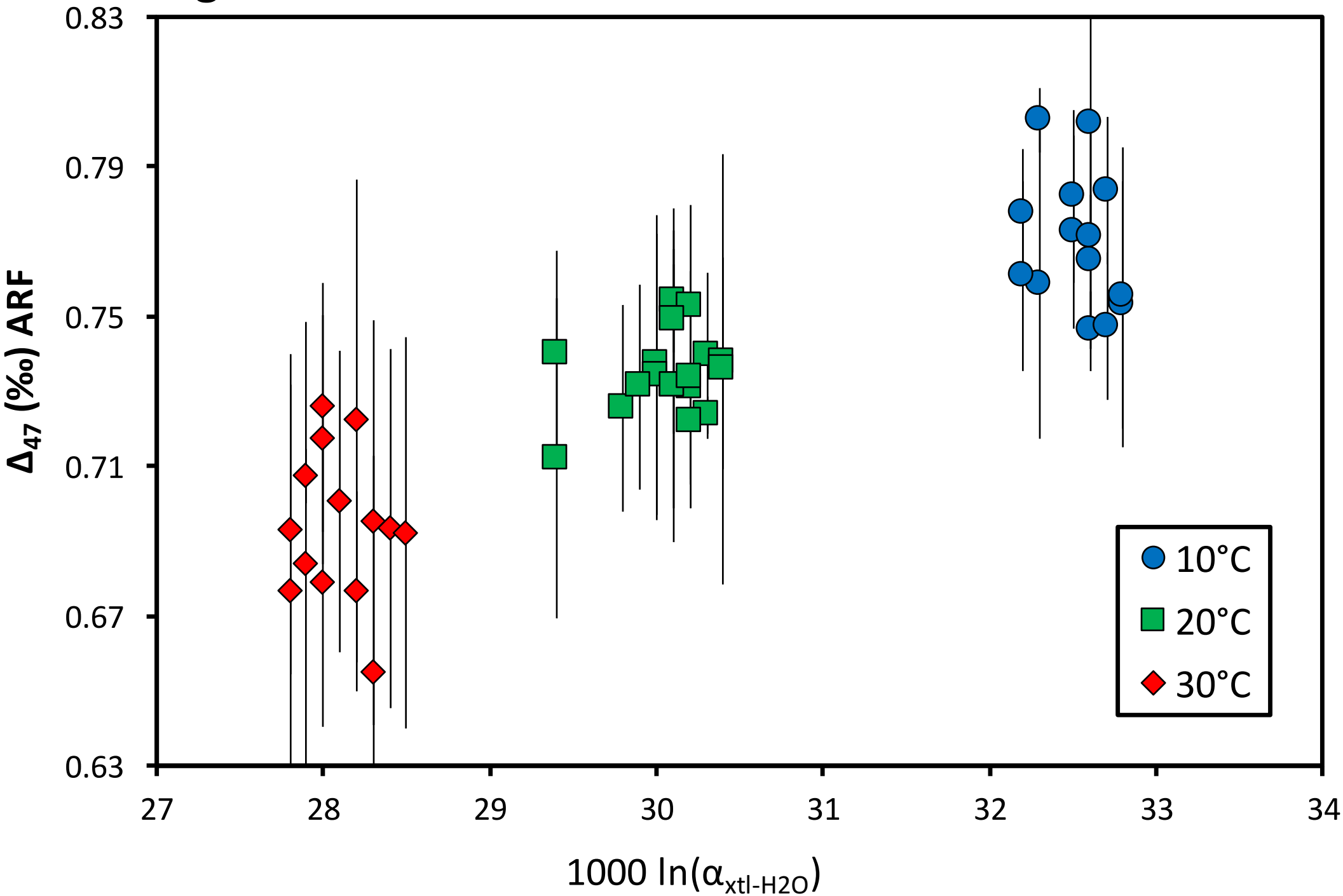


Figure S9
This Study, 30°C
Tang et al. (2014) adjusted to 30°C
Model Values
T = 30°C, pH = 6.6, θ = 100
T = 30°C, pH = 6.6, θ = 0.25
Δ47 (‰) ARF
0.80
0.78
0.76
0.74
0.72
0.70
0.68
0.66
0.64
0.62
0.60
-9.0
-8.0
-7.0
-6.0
-5.0
-4.0
-3.0
log Rate (moles m-2 s-1)

Figure S10


0.83
0.79
0.75
0.71
0.67
0.63
Δ47 (‰) ARF
27
28
29
30
31
32
33
34
1000 ln(αxtl-H2O)
10°C
20°C
30°C

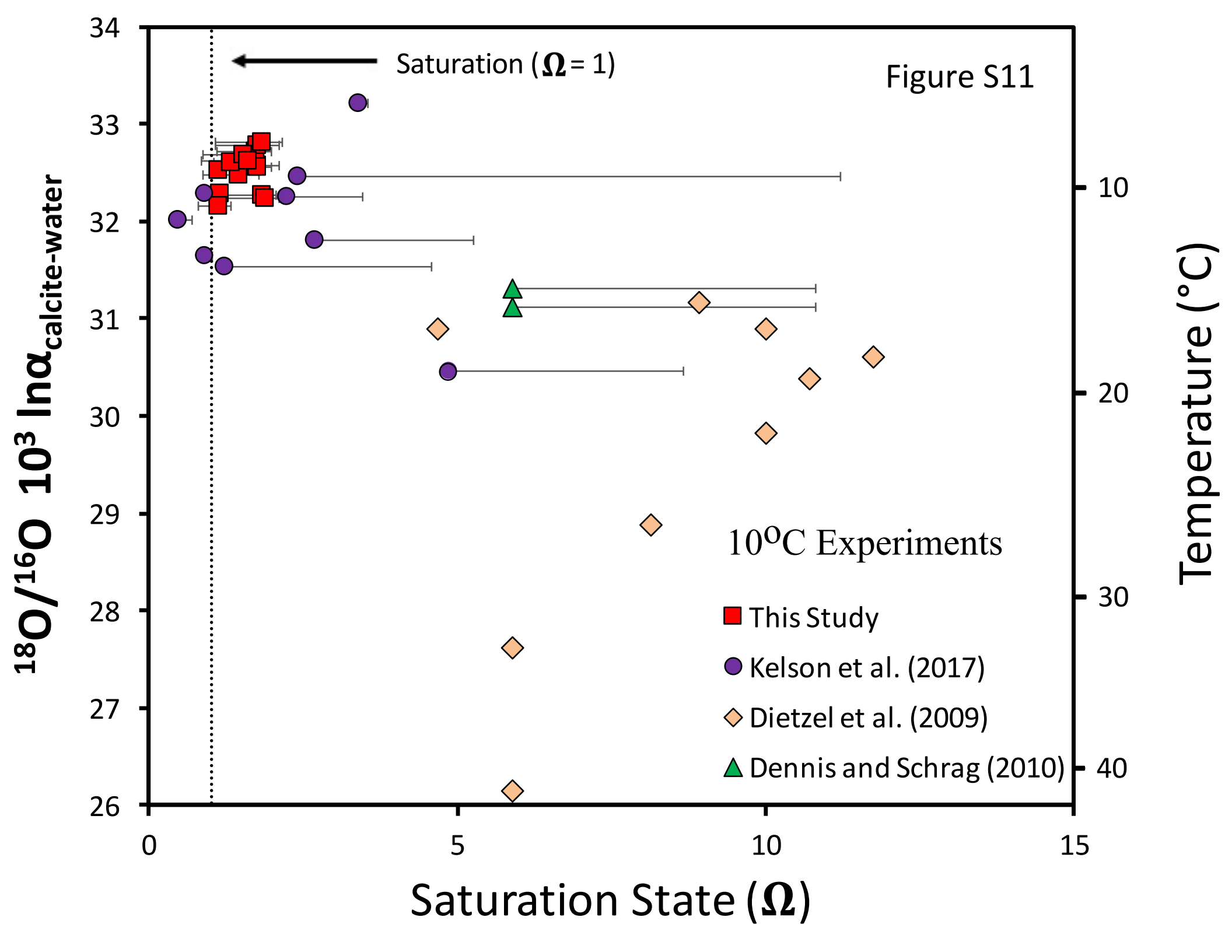


Figure S11
Saturation (Ω = 1)
10°C Experiments
This Study
Kelson et al. (2017)
Dietzel et al. (2009)
Dennis and Schrag (2010)
18O/16O 10³ lnα calcite-water
Temperature (°C)
Saturation State (Ω)
34
33
32
31
30
29
28
27
26
10
20
30
40
0
5
10
15

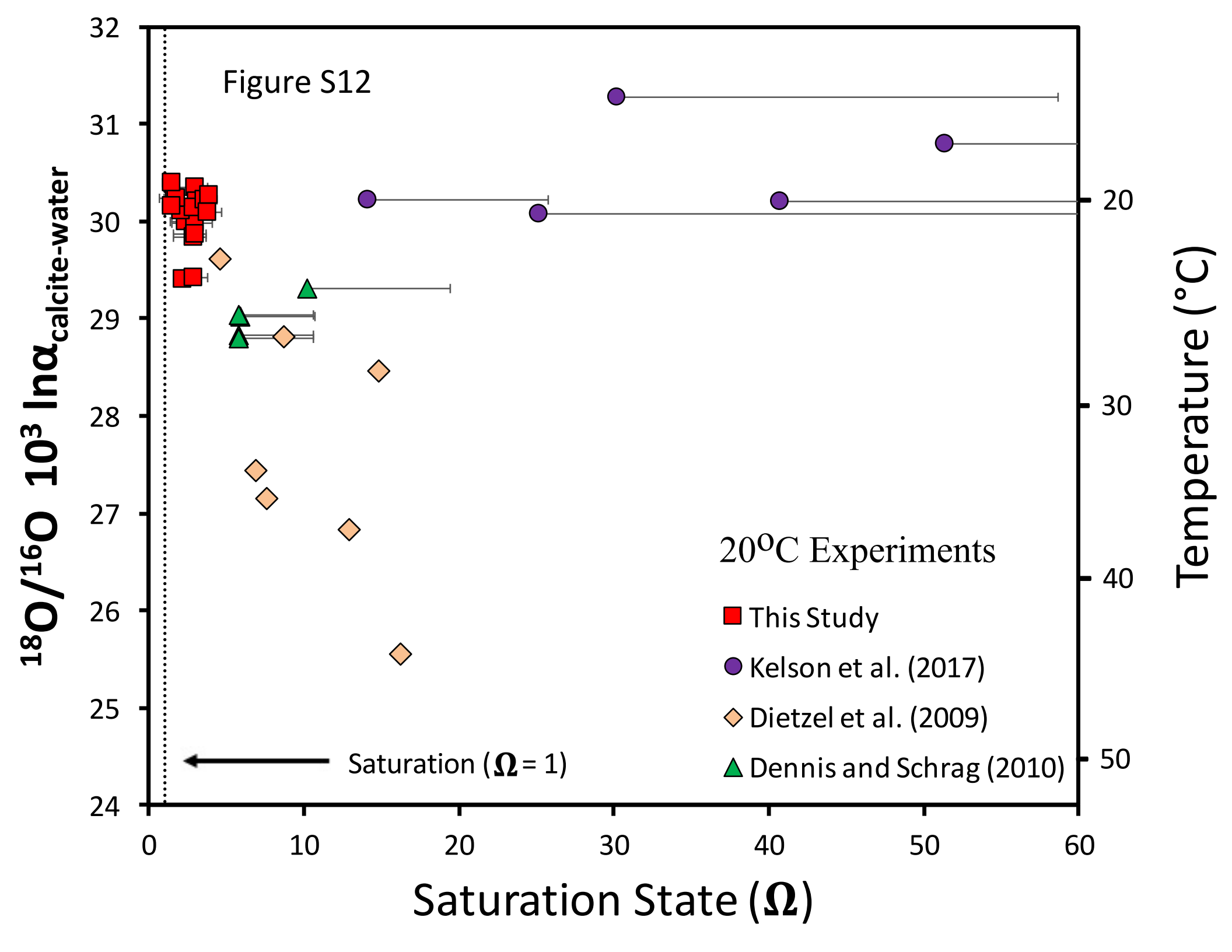


Figure S12
$^{18}O/^{16}O\ 10^3\ ln\alpha_{calcite\text{-}water}$
Temperature (°C)
Saturation State (Ω)
20°C Experiments
This Study
Kelson et al. (2017)
Dietzel et al. (2009)
Dennis and Schrag (2010)
Saturation (Ω = 1)
32
31
30
29
28
27
26
25
24
20
30
40
50
0
10
20
30
40
50
60

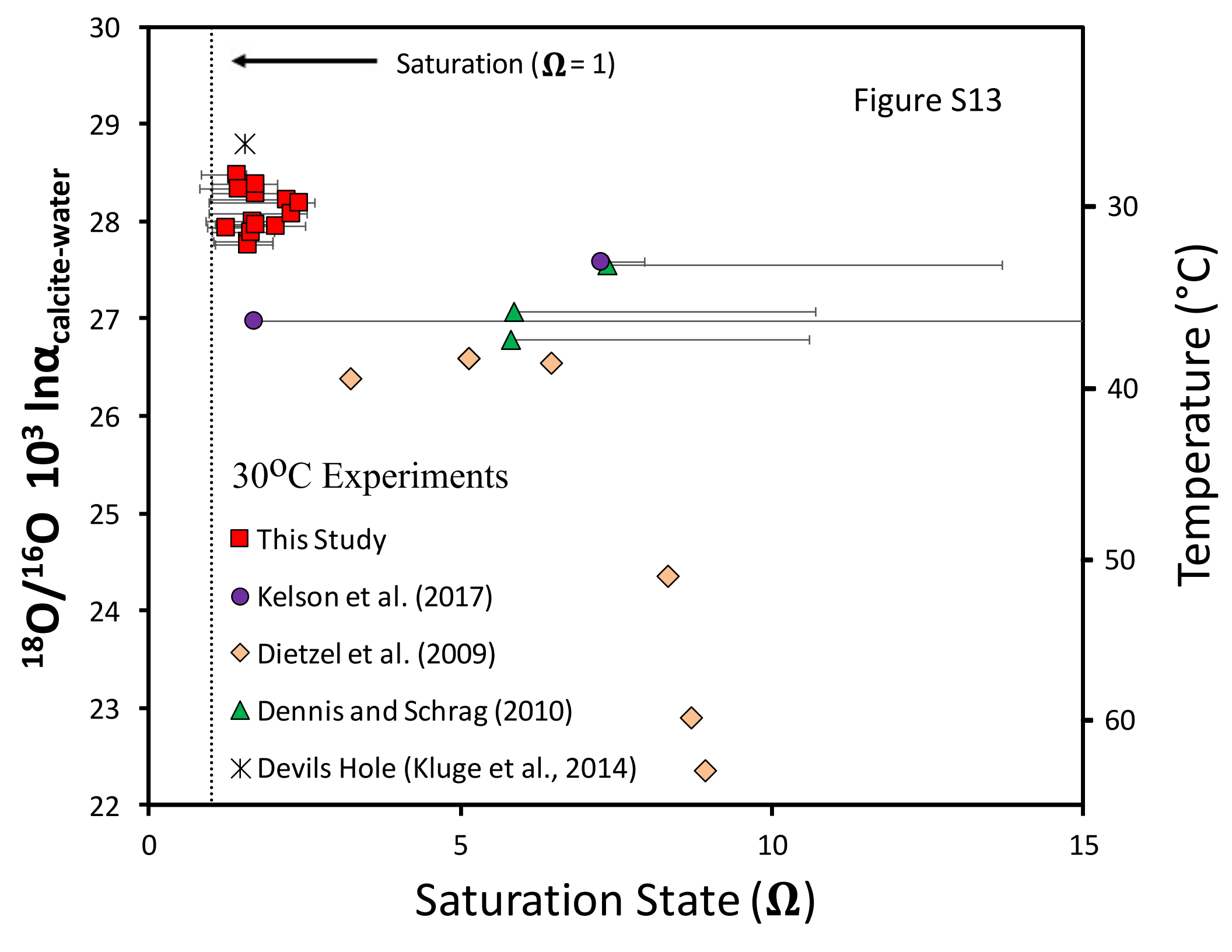
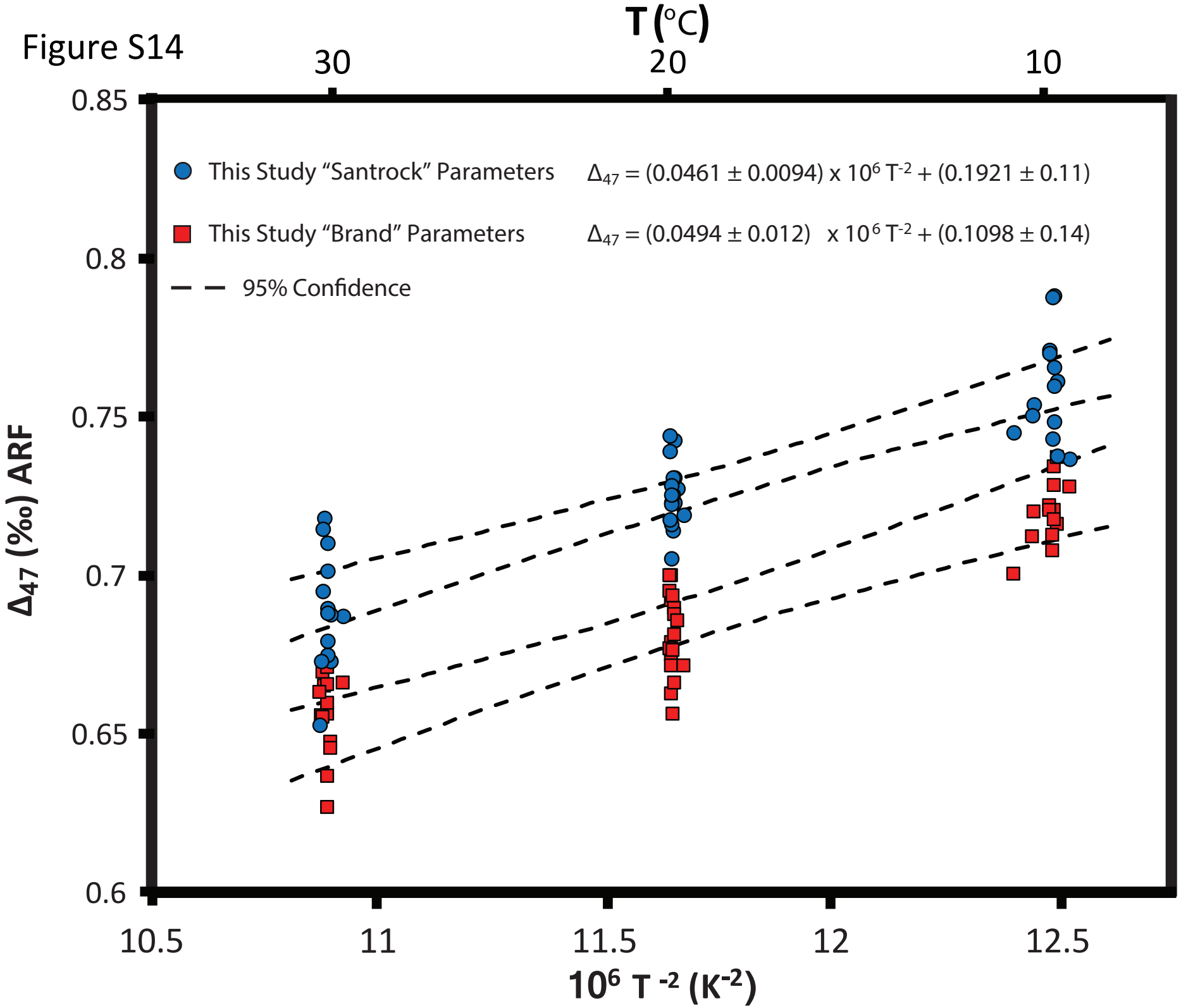


Figure S13
Saturation (Ω = 1)
30°C Experiments
This Study
Kelson et al. (2017)
Dietzel et al. (2009)
Dennis and Schrag (2010)
Devils Hole (Kluge et al., 2014)
18O/16O 10³ lnα calcite-water
Temperature (°C)
Saturation State (Ω)
30
29
28
27
26
25
24
23
22
0
5
10
15
30
40
50
60

Figure S14


T (°C)
30
20
10
0.85
0.8
0.75
0.7
0.65
0.6
This Study "Santrock" Parameters
$\Delta_{47} = (0.0461 \pm 0.0094) \times 10^6 T^{-2} + (0.1921 \pm 0.11)$
This Study "Brand" Parameters
$\Delta_{47} = (0.0494 \pm 0.012) \times 10^6 T^{-2} + (0.1098 \pm 0.14)$
95% Confidence
Δ_{47} (‰) ARF
10.5
11
11.5
12
12.5
$10^6 T^{-2} (K^{-2})$

Supplemental Tables Section

Table S1: Experimental Conditions and Supporting Isotope Compositions

Experiment			System T	Flow Rate (mL min^{-1})		pCO_2	pCO_2	pH	Ca^{2+} Initial	Ca^{2+} Final	Alkalinity Start	Alkalinity End	Calcite Saturation State (Ω)	
Identification	Date	Length (h)	(° C)	N_2	CO_2	(%)*	(%)**		(mmol)	(mmol)	(meq)	(meq)	Start	End
UWAI-016	20140414A	94	9.9	45.0	5.0	10.0	12.1	6.5	9.8	9.5	9.7	8.1	1.0	0.8
UWAI-017	20140414B	93	9.9	45.0	5.0	10.0	9.1	6.6	9.8	9.5	9.7	8.0	1.3	1.1
UWAI-018	20140420A	138	10.0	45.0	5.0	10.0	11.2	6.5	10.7	8.9	9.7	7.7	1.1	0.8
UWAI-019	20140420B	136	9.9	45.0	5.0	10.0	7.0	6.7	10.7	9.6	9.7	7.8	1.8	1.4
UWAI-025	20140607A	206	9.5	47.0	3.0	6.0	6.2	6.7	10.7	9.8	9.6	6.0	1.6	1.0
UWAI-026	20140607B	204	10.4	47.0	3.0	6.0	5.4	6.8	10.7	10.1	9.6	6.2	2.1	1.4
UWAI-027	20140617A	180	10.0	47.0	3.0	6.0	5.5	6.8	10.0	10.6	9.6	6.3	2.0	1.4
UWAI-028	20140617B	178	10.0	47.0	3.0	6.0	5.5	6.8	10.0	10.8	9.6	6.6	2.0	1.5
UWAI-029	20140626A	69	10.0	47.0	3.0	6.0	5.5	6.8	10.8	9.3	9.6	7.1	2.1	1.4
UWAI-030	20140626B	68	10.9	47.0	3.0	6.0	5.4	6.8	10.8	9.1	9.6	7.4	2.2	1.5
UWAI-031	20140630A	232	9.8	47.0	3.0	6.0	8.0	6.7	10.7	9.8	9.6	8.6	1.6	1.4
UWAI-032	20140630B	227	9.9	47.0	3.0	6.0	7.8	6.7	10.7	10.2	9.6	9.1	1.7	1.5
UWAI-033	20140711A	117	9.9	47.0	3.0	6.0	5.5	6.8	10.6	10.2	9.6	7.3	2.1	1.6
UWAI-034	20140711B	115	10.5	47.0	3.0	6.0	5.5	6.8	10.6	10.3	9.6	7.6	2.1	1.7
UWAI-002	20140214	151	20.0	47.5	2.5	5.0	5.9	6.8	11.4	8.8	9.8	6.1	3.1	1.7
UWAI-003	20140221	143	20.0	47.5	2.5	5.0	4.9	6.9	11.7	9.1	9.9	6.4	4.0	2.2
UWAI-004	20140227	144	20.0	47.5	2.5	5.0	4.8	6.9	11.1	9.0	9.9	6.3	3.8	2.2
UWAI-005	20140305	191	20.0	47.5	2.5	5.0	4.7	6.9	11.8	9.5	9.9	5.9	4.0	2.2
UWAI-006	20140314A	93	20.0	47.5	2.5	5.0	4.7	6.9	11.4	8.6	9.8	6.4	4.0	2.2
UWAI-007	20140314B	91	19.9	47.5	2.5	5.0	4.7	6.8	11.4	9.8	9.8	3.7	3.1	1.1
UWAI-008	20140320A	95	20.0	47.5	2.5	5.0	5.1	6.9	11.1	8.3	9.8	6.3	3.7	2.0
UWAI-009	20140320B	94	19.9	47.5	2.5	5.0	5.1	6.9	11.1	8.8	9.8	6.2	3.7	2.1
UWAI-010	20140325A	193	20.0	47.5	2.5	5.0	4.9	6.9	11.1	8.4	9.8	5.9	3.8	2.0
UWAI-011	20140325B	191	19.9	47.5	2.5	5.0	4.2	7.0	11.1	8.5	9.8	5.9	4.3	2.3
UWAI-012	20140403A	109	20.0	47.5	2.5	5.0	4.0	7.0	10.7	9.1	9.7	6.6	4.6	2.9
UWAI-013	20140403B	101	19.9	47.5	2.5	5.0	4.4	7.0	10.7	9.5	9.7	7.0	4.3	3.0
UWAI-014	20140409A	91	20.0	45.0	5.0	10.0	11.8	6.6	11.0	9.2	9.7	8.6	1.8	1.4
UWAI-015	20140409B	89	19.9	45.0	5.0	10.0	10.0	6.6	11.0	10.1	9.7	8.8	2.1	1.8
UWAI-023	20140531A	137	20.0	47.0	3.0	6.0	6.5	6.8	11.5	4.7	9.6	7.9	3.0	1.3
UWAI-024	20140531B	138	19.9	47.0	3.0	6.0	6.1	6.9	11.5	5.6	9.6	8.5	3.8	2.0
UWAI-045	20140823A	200	19.6	43.5	6.5	13.0	13.1	6.5	11.6	10.7	10.0	8.4	1.6	1.3
UWAI-046	20140823B	198	19.8	43.5	6.5	13.0	13.4	6.5	11.6	10.7	10.0	8.4	1.6	1.3
UWAI-020	20140427A	119	30.0	42.0	8.0	16.0	18.8	6.3	10.1	9.8	9.6	6.4	1.5	1.0
UWAI-021	20140427B	121	30.1	42.0	8.0	16.0	14.9	6.5	10.1	9.5	9.6	7.5	1.9	1.5
UWAI-035	20140717A	149	30.0	43.5	6.5	13.0	12.3	6.6	11.2	9.3	9.5	6.5	2.5	1.6
UWAI-036	20140717B	143	30.2	43.5	6.5	13.0	11.2	6.6	11.2	9.9	9.5	7.5	2.5	1.9
UWAI-037	20140724A	235	29.9	43.5	6.5	13.0	13.7	6.5	11.2	9.2	9.5	6.4	2.0	1.2
UWAI-038	20140724B	233	29.9	43.5	6.5	13.0	12.8	6.5	11.2	9.3	9.5	6.4	2.0	1.2
UWAI-039	20140804A	89	30.0	43.5	6.5	13.0	14.5	6.5	11.4	9.6	9.4	6.6	2.0	1.3
UWAI-040	20140804B	87	30.1	43.5	6.5	13.0	11.4	6.6	11.4	10.4	9.4	7.9	2.5	2.0
UWAI-041	20140810A	144	30.0	43.5	6.5	13.0	14.4	6.5	11.4	9.7	9.7	7.0	2.1	1.4
UWAI-042	20140810B	142	30.0	43.5	6.5	13.0	14.1	6.5	11.4	9.8	9.7	7.0	2.1	1.4
UWAI-043	20140817A	240	30.0	43.5	6.5	13.0	15.5	6.5	11.4	9.8	9.9	6.9	2.1	1.4
UWAI-044	20140817B	238	30.2	43.5	6.5	13.0	13.4	6.6	11.4	10.5	9.9	8.3	2.7	2.1
UWAI-047	20140901A	214	29.5	43.5	6.5	13.0	14.2	6.5	12.0	10.1	9.8	6.8	2.1	1.4
UWAI-048	20140901B	211	30.2	43.5	6.5	13.0	13.4	6.5	12.0	10.4	9.8	7.4	2.7	1.9
UWAI-001/022	Seed Crystals		20.0											

* pCO2 as established by mass flow controllers

** Equilibrium pCO2 calculated by PHREEQC according to measured solution conditions

Table S1 (cont.): Experimental Conditions and Supporting Isotope Compositions

Experiment		Seed Crystals	Overgrowth Mass (g)		Rate	log Rate	Rate	log Rate	$\delta^{13}C$ DIC (VPDB, ‰)		$\delta^{18}O$ H_2O (VSMOW, ‰)		$\delta^{43}Ca$ Calcite (HPS-932016, ‰)			
Identification	Date	(g)	Mass Balance	Isotope Dilution	(μmol m^{-2} h^{-1})		(mol m^{-2} s^{-1})		Start	End	Start	End	Calcite	Num. Analyses	Solution	Num. Analyses
UWAI-016	20140414A	0.080	0.109	0.090	103	2.0	2.9E-08	-7.5	-2.1	-2.0	-8.7	-9.0	44.7 ± 0.4	2	0.3 ± 0.3	3
UWAI-017	20140414B	0.080	0.111	0.091	105	2.0	2.9E-08	-7.5	-2.1	-1.9	-8.7	-9.0	42.4 ± 0.4	2	0.1 ± 0.4	3
UWAI-018	20140420A	0.080	0.128	0.107	84	1.9	2.3E-08	-7.6	-2.8	-2.0	-8.9	-9.0	40.7 ± 0.5	2	0.2 ± 0.6	2
UWAI-019	20140420B	0.081	0.125	0.114	90	2.0	2.5E-08	-7.6	-2.8	-1.9	-8.9	-8.9	39.3 ± 0.5	2	0.8	1
UWAI-025	20140607A	0.081	0.066	0.055	29	1.5	7.9E-09	-8.1	-2.7	-3.4	-8.9	-8.7	59.3 ± 5.1	6	-0.1 ± 1.2	3
UWAI-026	20140607B	0.081	0.062	0.055	29	1.5	8.0E-09	-8.1	-2.7	-3.2	-8.9	-8.8	56.4 ± 2.2	6	-0.2 ± 2.6	3
UWAI-027	20140617A	0.080	0.055	0.039	23	1.4	6.4E-09	-8.2	-2.0	-3.5	-8.9	-8.9	63.9 ± 0.3	2	0.3	1
UWAI-028	20140617B	0.081	0.041	0.038	23	1.4	6.3E-09	-8.2	-2.0	-3.4	-8.9	-9.0	64.5 ± 0.8	2	0.5	1
UWAI-029	20140626A	0.080	0.062	0.053	84	1.9	2.3E-08	-7.6	-2.2	-2.7	-9.2	-9.0	56.9 ± 0.0	2	0.4	1
UWAI-030	20140626B	0.080	0.048	0.045	72	1.9	2.0E-08	-7.7	-2.2	-2.9	-9.2	-9.0	61.4 ± 2.0	2	0.9	1
UWAI-031	20140630A	0.081	0.084	0.072	33	1.5	9.1E-09	-8.0	-3.3	-4.2	-9.3	-9.0	53.4 ± 8.3	2	0.3	1
UWAI-032	20140630B	0.081	0.056	0.059	28	1.4	7.7E-09	-8.1	-3.3	-4.0	-9.3	-8.6	56.1 ± 3.1	2	0.8	1
UWAI-033	20140711A	0.080	0.139	0.132	121	2.1	3.4E-08	-7.5	-1.6	-2.5	-8.7	-8.9	36.3 ± 0.5	2	0.5	1
UWAI-034	20140711B	0.080	0.128	0.126	118	2.1	3.3E-08	-7.5	-1.6	-2.4	-8.7	-8.8	37.1 ± 0.1	2	1.2	1
UWAI-002	20140214	0.080	0.219	0.179	128	2.1	3.6E-08	-7.4	-1.5	-2.8	-8.9	-8.9	29.0 ± 2.4	3	0.9	1
UWAI-003	20140221	0.080	0.194	0.135	102	2.0	2.8E-08	-7.5	-5.5	-2.9	-9.1	-9.0	35.2 ± 0.5	2	0.9	1
UWAI-004	20140227	0.079	0.174	0.146	110	2.0	3.1E-08	-7.5	-2.1	-2.8	-9.0	-8.9	33.5 ± 0.3	2	1.4	1
UWAI-005	20140305	0.080	0.166	0.143	81	1.9	2.2E-08	-7.7	-1.9	-3.3	-9.0	-8.8	34.0 ± 0.6	2	0.7	1
UWAI-006	20140314A	0.081	0.184	0.180	207	2.3	5.8E-08	-7.2	-1.5	-2.8	-8.8	-8.6	28.7 ± 2.2	2	-0.1	1
UWAI-007	20140314B	0.081	0.186	0.174	204	2.3	5.7E-08	-7.2	-1.5	-2.6	-8.8	-8.7	29.5 ± 3.9	2	-0.1	1
UWAI-008	20140320A	0.080	0.189	0.186	210	2.3	5.8E-08	-7.2	-4.8	-3.0	-8.6	-8.6	28.5 ± 1.5	2	0.8	1
UWAI-009	20140320B	0.080	0.189	0.171	195	2.3	5.4E-08	-7.3	-4.8	-2.8	-8.6	-8.9	30.3 ± 2.2	2	-0.2	1
UWAI-010	20140325A	0.081	0.184	0.148	82	1.9	2.3E-08	-7.6	-2.4	-3.0	-8.8	-8.7	33.4 ± 0.7	2	0.8 ± 3.6	2
UWAI-011	20140325B	0.080	0.192	0.166	93	2.0	2.6E-08	-7.6	-2.4	-2.9	-8.8	-9.0	31.0 ± 0.5	2	0.4 ± 0.2	3
UWAI-012	20140403A	0.080	0.149	0.152	150	2.2	4.2E-08	-7.4	-2.4	-2.5	-9.1	-8.4	32.8 ± 0.7	2	-0.7 ± 3.7	2
UWAI-013	20140403B	0.081	0.132	0.125	132	2.1	3.7E-08	-7.4	-2.4	-2.5	-9.1	-8.6	37.3 ± 0.8	2	0.3	1
UWAI-014	20140409A	0.080	0.086	0.095	113	2.1	3.1E-08	-7.5	-4.0	-3.1	-8.7	-8.7	43.3 ± 0.7	2	0.5	1
UWAI-015	20140409B	0.081	0.082	0.076	92	2.0	2.5E-08	-7.6	-4.0	-3.0	-8.7	-8.9	48.5 ± 1.0	2	0.6	1
UWAI-023	20140531A	0.080	0.490	0.454	358	2.6	1.0E-07	-7.0	-2.9	-3.2	-8.4	-8.1	12.7 ± 2.5	4	0.1 ± 1.9	3
UWAI-024	20140531B	0.080	0.470	0.610	477	2.7	1.3E-07	-6.9	-2.9	-3.4	-8.4	-8.1	13.0 ± 4.1	4	1.9 ± 1.3	2
UWAI-045	20140823A	0.080	0.100	0.080	43	1.6	1.2E-08	-7.9	-3.4	-4.7	-8.8	-8.6	47.3 ± 1.0	2	1.0	1
UWAI-046	20140823B	0.080	0.103	0.100	54	1.7	1.5E-08	-7.8	-3.4	-5.0	-8.8	-9.1	41.9 ± 1.4	2	1.2	1
UWAI-020	20140427A	0.080	0.171	0.160	145	2.2	4.0E-08	-7.4	-3.5	-5.5	-9.1	-8.7	31.6 ± 0.6	2	1.8 ± 3.3	3
UWAI-021	20140427B	0.080	0.149	0.136	122	2.1	3.4E-08	-7.5	-3.5	-6.0	-9.1	-8.1	34.9 ± 0.9	2	-1.8 ± 3.9	3
UWAI-035†	20140717A	NA	0.187	NA	110	2.0	3.1E-08	-7.5	-3.9	-5.1	-8.8	-8.9	0.0 ± 0.0	2	1.2	1
UWAI-036	20140717B	0.080	0.149	0.146	110	2.0	3.1E-08	-7.5	-3.9	-4.6	-8.8	-8.9	33.5 ± 1.0	2	0.0	1
UWAI-037	20140724A	0.081	0.187	0.178	81	1.9	2.3E-08	-7.6	-4.0	-4.9	-8.5	-8.6	30.0 ± 0.4	2	0.3	1
UWAI-038	20140724B	0.079	0.191	0.170	80	1.9	2.2E-08	-7.7	-4.0	-5.0	-8.5	-8.7	29.1 ± 3.6	2	0.2	1
UWAI-039	20140804A	0.082	0.173	0.168	200	2.3	5.6E-08	-7.3	-4.0	-5.0	-8.3	-8.9	29.3 ± 5.4	2	0.4	1
UWAI-040	20140804B	0.082	0.118	0.125	152	2.2	4.2E-08	-7.4	-4.0	-4.5	-8.3	-9.1	39.3 ± 4.6	2	0.5	1
UWAI-041	20140810A	0.080	0.179	0.180	136	2.1	3.8E-08	-7.4	-4.0	-4.9	-9.3	-8.7	29.3	1	0.8	1
UWAI-042	20140810B	0.081	0.177	0.164	123	2.1	3.4E-08	-7.5	-4.0	-4.5	-9.3	-9.1	31.9 ± 7.2	3	0.4	1
UWAI-043	20140817A	0.081	0.162	0.154	68	1.8	1.9E-08	-7.7	-4.0	-5.3	-9.2	-8.2	32.5 ± 1.4	2	0.6	1
UWAI-044	20140817B	0.081	0.108	0.105	47	1.7	1.3E-08	-7.9	-4.0	-4.4	-9.2	-8.4	42.8 ± 3.7	2	0.4	1
UWAI-047	20140901A	0.081	0.166	0.164	82	1.9	2.3E-08	-7.6	-5.1	-6.6	-9.2	-8.9	32.7 ± 3.2	2	0.2	1
UWAI-048	20140901B	0.081	0.150	0.106	53	1.7	1.5E-08	-7.8	-5.1	-6.5	-9.2	-9.8	40.1 ± 3.5	2	0.0	1
UWAI-001/022	Seed Crystals												94.6 ± 2.1	4		
	Reagent $CaCl_2$												0.4 ± 0.0	3		

Error values represent 2 standard deviations about the mean of multiple analyses

† Experiment UWAI-035 homogeneously nucleated

Precipitation Rate unknown due to homogeneous nucleation, rate estimated based on experiment UWAI-036

Table S2: Standards, Heated Gasses, and Equilibrated Gasses Analyzed During Clumped Isotope Analyses

Measurement			$\delta^{13}C$		$\delta^{18}O$ gas	$\delta^{18}O$ mineral		δ45 raw	δ46 raw	δ47 raw		Δ_{47} raw			δ48 raw		Δ_{48} raw		δ49 raw		CIT	CIT	ARF	ARF
Week	Type	Name	VPDB (‰)	1σ	VSMOW (‰)	PDB (‰)	1σ	(‰)	(‰)	(‰)	1σ	(v. Oz)	1σ	sterror	(v. Oz)	1σ	(v. Oz)	1σ	(v. Oz)	1σ	slope	intercept	slope	intercept
1	Standard	TV03	3.417	0.005	30.408	-8.578	0.015	6.709	5.276	12.049	0.046	-0.096	0.029	0.010	15.998	0.673	5.361	0.648	-1.425	0.932	0.012	-0.779	1.124	0.012
1	Standard	CIT Carrara	2.115	0.004	37.308	-1.939	0.019	5.728	11.998	17.485	0.036	-0.290	0.021	0.007	35.223	0.769	10.823	0.736	-1.541	0.991	0.012	-0.779	1.124	0.012
1	Standard	TV03	3.348	0.002	30.299	-8.683	0.032	6.641	5.170	11.887	0.049	-0.081	0.029	0.010	16.588	0.873	6.158	0.809	-2.405	0.997	0.012	-0.779	1.124	0.012
1	Standard	CIT Carrara	2.101	0.003	37.329	-1.919	0.036	5.715	12.018	17.536	0.072	-0.246	0.039	0.014	37.149	1.278	12.662	1.179	-3.436	1.113	0.013	-0.691	1.124	0.012
1	Standard	TV03	3.461	0.004	30.545	-8.446	0.054	6.756	5.410	12.288	0.089	-0.037	0.038	0.014	18.875	2.078	7.940	1.952	-3.786	2.035	0.013	-0.691	1.124	0.012
1	Standard	CIT Carrara	2.120	0.003	37.420	-1.831	0.069	5.736	12.107	17.642	0.087	-0.249	0.040	0.014	38.731	1.691	14.028	1.525	-4.747	1.750	0.013	-0.691	1.124	0.012
1	Standard	TV03	3.438	0.004	30.532	-8.458	0.076	6.733	5.397	12.263	0.120	-0.027	0.048	0.017	19.548	1.899	8.630	1.735	-4.902	1.929	0.013	-0.691	1.124	0.012
1	Standard	CIT Carrara	2.127	0.002	37.444	-1.808	0.065	5.743	12.131	17.713	0.086	-0.211	0.044	0.015	39.474	1.794	14.706	1.627	-5.932	1.465	0.013	-0.691	1.124	0.012
1	Standard	CIT Carrara	2.069	0.003	37.102	-2.138	0.007	5.678	11.796	17.255	0.060	-0.268	0.065	0.023	33.013	0.423	9.066	0.415	0.325	0.706	0.013	-0.691	1.124	0.012
1	Standard	TV03	3.373	0.005	30.257	-8.724	0.009	6.661	5.051	11.862	0.051	-0.088	0.049	0.017	13.853	0.470	3.534	0.457	0.659	0.857	0.013	-0.688	1.124	0.012
1	Standard	CIT Carrara	2.071	0.004	37.096	-2.143	0.010	5.680	11.791	17.287	0.030	-0.234	0.029	0.011	32.767	0.436	8.836	0.411	0.419	0.857	0.013	-0.688	1.124	0.012
1	Standard	TV03	3.397	0.005	30.339	-8.645	0.009	6.688	5.208	11.974	0.047	-0.082	0.047	0.017	14.549	0.807	4.063	0.786	0.008	1.338	0.012	-0.688	1.124	0.012
1	Standard	TV03	3.402	0.003	30.317	-8.665	0.006	6.693	5.187	11.951	0.056	-0.088	0.053	0.019	14.231	0.549	3.790	0.539	0.606	0.785	0.012	-0.688	1.124	0.012
1	Heated Gas	BOC	-10.988	0.005	29.382	-9.566	0.023	-6.797	4.244	-3.690	0.034	-0.829	0.027	0.010	11.452	0.530	2.922	0.501	0.461	0.827	0.012	-0.779	1.124	0.012
1	Heated Gas	BOC	-10.906	0.004	30.464	-8.524	0.041	-6.682	5.299	-2.482	0.079	-0.769	0.049	0.017	17.263	1.642	6.567	1.557	-2.686	1.819	0.012	-0.779	1.124	0.012
1	Heated Gas	eBOC	-10.775	0.003	60.274	20.158	0.056	-5.546	34.350	27.455	0.085	-0.397	0.031	0.011	102.693	1.953	30.669	1.722	-4.955	2.078	0.012	-0.779	1.124	0.012
1	Heated Gas	eBOC	-10.726	0.005	54.672	14.767	0.012	-5.690	28.891	21.986	0.078	-0.382	0.075	0.027	82.280	0.740	22.354	0.680	0.100	1.128	0.013	-0.691	1.124	0.012
1	Heated Gas	BOC	-10.164	0.004	31.507	-7.520	0.011	-5.953	6.317	-0.655	0.059	-0.692	0.057	0.020	17.430	0.730	4.696	0.703	0.310	1.268	0.013	-0.691	1.124	0.012
1	Heated Gas	eBOC	-10.661	0.002	58.993	18.926	0.011	-5.483	33.102	26.250	0.041	-0.449	0.048	0.017	95.150	0.561	26.093	0.524	-1.130	0.768	0.013	-0.691	1.124	0.012
1	Heated Gas	eBOC	-10.751	0.003	59.435	19.350	0.015	5.960	6.733	26.647	0.050	-0.400	0.060	0.021	95.917	0.527	25.957	0.472	-0.234	0.808	0.013	-0.691	1.124	0.012
1	Heated Gas	BOC	-10.611	0.026	33.936	-5.184	0.030	-6.406	5.090	-2.187	0.127	-0.556	0.137	0.048	13.958	0.583	3.714	0.577	0.940	1.085	0.013	-0.691	1.124	0.012
1	Heated Gas	BOC	-10.374	0.007	30.505	-8.485	0.014	-6.184	5.340	-1.724	0.128	-0.568	0.141	0.050	15.001	0.624	4.247	0.600	0.514	0.733	0.013	-0.691	1.124	0.012
1	Heated Gas	BOC	-10.739	0.004	31.028	-7.982	0.005	-6.507	5.849	-0.721	0.022	0.275	0.020	0.007	18.590	0.466	6.778	0.460	-2.305	0.389	0.013	-0.691	1.124	0.012
1	Heated Gas	eBOC	-10.565	0.002	59.899	19.797	0.010	-5.363	33.986	27.329	0.062	-0.364	0.065	0.023	96.922	0.574	25.998	0.533	0.423	0.853	0.013	-0.691	1.124	0.012
1	Equilibrated Gas	BOC 25degC	-10.634	0.003	63.367	23.133	0.010	-5.311	37.364	31.417	0.022	0.345	0.024	0.008	105.965	0.355	27.729	0.321	-0.049	0.767	0.012	-0.688	1.124	0.012
1	Equilibrated Gas	BOC 25degC	-10.825	0.003	28.581	-10.336	0.028	-6.923	4.305	-3.544	0.047	-0.049	0.027	0.010	9.986	0.496	3.024	0.497	0.117	0.859	0.013	-0.691	1.124	0.012
1	Equilibrated Gas	BOC 25degC	-10.489	0.003	28.675	-10.246	0.008	-6.354	3.556	-3.118	0.027	-0.041	0.021	0.008	8.956	0.488	1.818	0.471	1.991	0.718	0.012	-0.688	1.124	0.012
2	Standard	TV03	3.397	0.001	30.540	-8.451	0.014	6.763	5.451	12.342	0.036	-0.026	0.042	0.015	17.269	0.137	6.283	0.257	-3.386	0.237	0.019	-0.838	1.006	0.017
2	Standard	CIT Carrera	2.129	0.002	37.382	-1.868	0.003	5.814	12.128	17.740	0.020	-0.233	0.022	0.008	38.327	0.204	13.629	0.245	-2.993	0.177	0.019	-0.838	1.006	0.017
2	Standard	TV03	3.440	0.001	30.525	-8.465	0.006	6.803	5.432	12.351	0.039	-0.043	0.039	0.014	17.318	0.299	6.360	0.111	-2.943	0.397	0.019	-0.838	1.006	0.017
2	Standard	CIT Carrera	2.127	0.001	37.402	-1.849	0.003	5.810	12.128	17.754	0.031	-0.237	0.030	0.010	38.609	0.343	13.865	0.185	-3.008	0.205	0.019	-0.838	1.006	0.017
2	Standard	TV03	3.385	0.002	30.535	-8.456	0.004	6.752	5.440	12.313	0.026	-0.038	0.026	0.009	17.334	0.320	6.356	0.206	-2.549	0.271	0.019	-0.838	1.006	0.017
2	Standard	CIT Carrera	2.139	0.003	37.406	-1.845	0.004	5.820	12.127	17.778	0.020	-0.228	0.016	0.006	38.493	0.258	13.744	0.124	-3.191	0.274	0.019	-0.838	1.006	0.017
2	Standard	TV03	3.422	0.001	30.534	-8.457	0.009	6.786	5.442	12.330	0.015	-0.055	0.015	0.005	17.588	0.197	6.610	0.193	-3.563	0.252	0.019	-0.838	1.006	0.017
2	Standard	TV03	3.414	0.003	30.580	-8.413	0.005	6.782	5.484	12.404	0.024	-0.019	0.025	0.009	17.946	0.245	6.875	0.242	-3.126	0.295	0.019	-0.838	1.006	0.017
2	Standard	CIT Carrera	2.134	0.002	37.417	-1.834	0.004	5.817	12.144	17.792	0.042	-0.220	0.042	0.015	39.037	0.200	14.254	0.387	-2.941	0.390	0.019	-0.838	1.006	0.017
2	Standard	TV03	3.440	0.002	30.531	-8.460	0.004	6.804	5.436	12.360	0.016	-0.040	0.013	0.005	17.567	0.231	6.595	0.250	-3.075	0.299	0.019	-0.838	1.006	0.017
2	Standard	CIT Carrera	2.138	0.002	37.399	-1.851	0.003	5.820	12.086	17.795	0.035	-0.203	0.034	0.012	39.057	14.308	0.252	0.277	-3.993	0.350	0.019	-0.838	1.006	0.017
2	Standard	CIT Carrara	2.135	0.003	37.400	-1.851	0.007	5.817	12.144	17.800	0.039	-0.197	0.038	0.013	38.842	0.228	14.097	0.229	-2.941	0.390	0.019	-0.805	1.006	0.017
2	Standard	CIT Carrara	2.137	0.002	37.396	-1.855	0.002	5.818	12.124	17.782	0.025	-0.212	0.025	0.009	39.177	0.241	14.432	0.239	-2.800	0.322	0.019	-0.805	1.006	0.017
2	Standard	TV03	3.475	0.001	30.505	-8.485	0.003	6.834	5.410	12.384	0.031	-0.024	0.032	0.011	17.606	0.195	6.684	0.190	-3.098	0.250	0.019	-0.805	1.006	0.017
2	Heated Gas	BOC	-11.300	0.001	29.389	-9.559	0.004	-7.021	4.289	-3.948	0.033	-0.899	0.034	0.012	13.458	0.230	4.818	0.168	-2.046	0.199	0.019	-0.805	1.006	0.017
2	Heated Gas	eboc	-10.531	0.001	55.524	15.587	0.010	-5.412	29.758	23.147	0.033	-0.366	0.027	0.010	95.623	0.207	33.207	0.242	-6.115	0.384	0.019	-0.805	1.006	0.017
2	Heated Gas	eBOC	-10.666	0.003	56.880	16.893	0.007	-5.493	31.081	24.329	0.036	-0.390	0.031	0.011	101.015	0.263	35.632	0.206	-4.573	0.299	0.019	-0.805	1.006	0.017
2	Heated Gas	BOC	-10.759	0.002	30.437	-8.550	0.002	-6.480	5.312	-2.364	0.040	-0.873	0.041	0.014	16.871	0.315	6.152	0.293	-2.054	0.248	0.019	-0.805	1.006	0.017
2	Heated Gas	eBOC	-10.779	0.001	55.556	15.618	0.004	-5.645	29.802	22.922	0.027	-0.375	0.025	0.009	96.135	0.1861	33.629	0.243	-2.411	0.272	0.019	-0.805	1.006	0.017
2	Heated Gas	BOC	-10.770	0.002	29.645	-9.312	0.004	-6.517	4.541	-3.137	0.033	-0.855	0.032	0.011	14.362	0.215	5.213	0.215	-1.077	0.217	0.019	-0.805	1.006	0.017
2	Heated Gas	eBOC	-10.485	0.002	55.110	15.189	0.005	-5.384	29.359	22.778	0.022	-0.372	0.020	0.007	95.165	0.192	33.583	0.180	-4.615	0.274	0.019	-0.805	1.006	0.017
2	Equilibrated Gas	25C eBOC	-11.107	0.002	62.055	21.872	0.012	-5.731	36.126	30.061	0.044	0.639	0.034	0.012	117.153	0.376	40.609	0.364	-7.394	0.329	0.019	-0.805	1.006	0.017
2	Equilibrated Gas	25C BOC	-10.466	0.001	28.761	-10.162	0.006	-6.263	3.680	-2.869	0.032	-0.007	0.032	0.011	11.966	0.137	4.559	0.144	-3.428	0.392	0.019	-0.805	1.006	0.017
2	Equilibrated Gas	25C eBOC	-10.836	0.004	60.660	20.529	0.007	-5.525	34.767	28.848	0.016	0.538	0.015	0.005	115.163	0.568	41.486	0.538	-2.994	0.317	0.019	-0.805	1.006	0.017
2	Equilibrated Gas	25C eBOC	-10.704	0.002	60.604	20.476	0.008	-5.403	34.713	28.905	0.043	0.520	0.041	0.015	113.186	0.153	39.748	0.147	-3.617	0.427	0.019	-0.805	1.006	0.017
3	Standard	CIT Carrara	2.105	0.005	37.433	-1.819	0.021	5.715	11.922	17.394	0.044	-0.290	0.035	0.012	33.828	0.483	9.217	0.434	0.026	0.819	0.012	-0.757	1.131	0.012
3	Standard	TV03	3.482	0.012	30.518	-8.473	0.008	6.763	4.792	11.596	0.028	-0.083	0.023	0.008	15.042	0.483	4.201	0.464	-1.269	0.690	0.012	-0.757	1.131	0.012
3	Standard	TV03	3.462	0.007	30.501	-8.489	0.012	6.755	5.367	12.169	0.063	-0.111	0.063	0.022	14.503	0.477	3.701	0.457	0.488	0.787	0.012	-0.757	1.131	0.012
3	Standard	CIT Carrera	2.134	0.008	37.330	-1.918	0.022	5.747	12.019	17.502	0.034	-0.313	0.025	0.009	33.122	0.865	8.727	0.807	0.103	1.162	0.012	-0.757	1.131	0.012
3	Standard	CIT Carrera	1.565	0.010	37.859	-1.409	0.015	5.238	12.538	17.482	0.046	-0.315	0.032	0.011	34.793	0.803	9.325	0.765	-0.291	1.447	0.012	-0.757	1.131	0.012
3	Standard	TV03	3.394	0.006	30.413	-8.574	0.023	6.688	5.281	12.029	0.042	-0.098	0.037	0.013	14.473	0.537	3.843	0.506	-0.456	0.955	0.012	-0.757	1.131	0.012
3	Standard	Carrera	2.104	0.005	37.231	-2.014	0.009	5.715	11.922	17.394	0.055	-0.292	0.046	0.016	32.811	0.552	8.618	0.528	0.026	0.819	0.012	-0.757	1.131	0.012
3	Standard	TV03	3.457	0.006	30.526	-8.465	0.019	6.751	5.391	12.189	0.057	-0.113	0.036	0.013	14.794	0.645	3.940	0.618	0.043	1.027	0.012	-0.757	1.131	0.012
3	Standard	CIT Carrera	2.121	0.008	37.276	-1.970	0.017	5.732	11.967	17.446	0.058	-0.301	0.047	0.017	33.443	0.769	9.146	0.723	-0.873	1.351	0.012	-0.757	1.131	0.012
3	Standard	TV03	2.431	0.017	31.720	-7.316	0.035	5.832	6.552	12.382	0.110	-0.116	0.061	0.022	19.032	2.089	5.808	1.995	-2.303	3.239	0.012	-0.757	1.131	0.012
3	Heated Gas	BOC	-10.923	0.010	29.750	-9.211	0.024	-6.723	4.603	-3.266	0.060	-0.832	0.038	0.013	12.568	1.163	3.309	1.110	-0.521	2.598	0.012	-0.757	1.131	0.012
3	Heated Gas	eBOC	-10.905	0.007	57.005	17.013	0.021	-5.779	31.164	24.002	0.050	-0.489	0.035	0.012	87.530	0.643	22.788	0.590	-0.597	0.852	0.012	-0.757	1.131	0.012
3	Heated Gas	eBOC	-10.948	0.005	56.941	16.951	0.016	-5.821	31.102	23.904	0.029	-0.482	0.019	0.007	87.110	0.573	22.516	0.514	-0.944	0.698	0.012	-0.757	1.131	0.012
3	Heated Gas	BOC	-10.952	0.004	30.011	-8.961	0.016	-6.741	4.857	-3.028	0.040	-0.822	0.039	0.014	13.572	0.606	3.798	0.576	-0.637	1.408	0.012	-0.757	1.131	0.012
3	Heated Gas	eBOC	-10.899	0.005	55.472	15.537	0.013	-5.825	29.670	22.482	0.046	-0.501	0.038	0.013	82.627	0.600	21.134	0.556	-0.514	0.873	0.012	-0.757	1.131	0.012
3	Equilibrated Gas	BOC 25C	-10.523	0.003	28.978	-9.954	0.006	-6.376	3.851	-2.852	0.041	-0.041	0.036	0.013	10.321	0.379	2.583	0.368	0.743	0.542	0.012	-0.757	1.131	0.012
3	Equilibrated Gas	25C eBOC	-10.978	0.006	63.423	23.188	0.018	-5.630	37.419	31.139	0.052	0.355	0.043	0.015	105.718	0.716	27.392	0.646	-0.364	1.158	0.012	-0.757	1.131	0.012
3	Equilibrated Gas	25C eBOC	-10.731	0.003	58.799	18.739	0.023	-5.555	32.913	26.771	0.049	0.313	0.034	0.012	92.946	0.496	24.404	0.446	-0.785	0.766	0.012	-0.757	1.131	0.012
3	Equilibrated Gas	25C BOC	-10.749	0.007	26.220	-12.608	0.010	-6.513	3.735	-3.135	0.045	-0.091	0.033	0.012	2.924	0.592	0.596	0.574	-1.454	0.453	0.012	-0.757	1.131	0.012
3	Equilibrated Gas	25C eBOC	-10.920	0.008	60.312	20.194	0.010	-5.711	34.270	28.135	0.037	0.369	0.031	0.011	102.263	1.070	30.194	0.982	-1.347	0.832	0.012	-0.757	1.131	0.012

Table S2 (cont): Standards, Heated Gasses, and Equilibrated Gasses Analyzed During Clumped Isotope Analyses

Measurement			$\delta^{13}C$		$\delta^{18}O$ gas	$\delta^{18}O$ mineral		δ45 raw	δ46 raw	δ47 raw		Δ_{47} raw			δ48 raw		Δ_{48} raw		δ49 raw		CIT	CIT	ARF	ARF
Week	Type	Name	VPDB (‰)	1σ	VSMOW (‰)	PDB (‰)	1σ	(‰)	(‰)	(‰)	1σ	(v. Oz)	1σ	sterror	(v. Oz)	1σ	(v. Oz)	1σ	(v. Oz)	1σ	slope	intercept	slope	intercept
4	Standard	CIT Carrara	2.020	0.003	37.003	-2.233	0.006	5.628	11.700	17.118	0.024	-0.258	0.022	0.008	34.782	0.270	10.986	0.257	-0.737	0.386	0.013	-0.774	1.078	0.012
4	Standard	TV03	3.309	0.002	30.204	-8.775	0.006	6.602	5.077	11.767	0.025	-0.069	0.026	0.009	15.342	0.378	5.111	0.371	-0.868	0.322	0.013	-0.774	1.078	0.012
4	Standard	NBS-19	1.830	0.002	36.346	-2.865	0.003	5.429	11.060	16.239	0.037	-0.295	0.035	0.013	32.827	0.250	10.355	0.247	-0.747	0.553	0.013	-0.774	1.078	0.012
4	Standard	TV03	3.372	0.002	30.305	-8.678	0.006	6.664	5.175	11.912	0.022	-0.085	0.023	0.008	15.601	0.265	5.170	0.261	-0.740	0.238	0.013	-0.774	1.078	0.012
4	Standard	CIT Carrara	1.355	0.002	37.929	-1.342	0.004	5.038	12.601	17.359	0.032	-0.292	0.032	0.011	37.567	0.397	11.905	0.385	-1.102	0.552	0.013	-0.775	1.078	0.012
4	Standard	TV03	3.282	0.001	30.116	-8.859	0.005	6.573	4.991	11.626	0.022	-0.094	0.025	0.009	14.916	0.237	4.860	0.234	-0.834	0.213	0.013	-0.775	1.078	0.012
4	Standard	CIT Carrara	1.962	0.003	36.841	-2.388	0.003	5.569	11.543	16.854	0.021	-0.304	0.023	0.008	33.843	0.264	10.383	0.258	-0.783	0.329	0.013	-0.777	1.078	0.012
4	Standard	TV03	3.205	0.002	29.945	-9.023	0.004	6.495	4.825	11.378	0.019	-0.097	0.019	0.007	14.356	0.289	4.639	0.285	-0.511	0.430	0.013	-0.777	1.078	0.012
4	Standard	NBS-19	1.758	0.010	36.176	-3.028	0.016	5.355	10.894	15.98	0.027	-0.314	0.028	0.010	31.631	0.456	9.517	0.473	-0.668	0.451	0.013	-0.777	1.078	0.012
4	Standard	TV03	3.149	0.001	30.197	-8.781	0.005	6.451	5.070	11.59	0.030	-0.083	0.028	0.010	14.711	0.275	4.499	0.272	-0.516	0.189	0.013	-0.777	1.078	0.012
4	Standard	CIT Carrara	1.893	0.002	36.669	-2.554	0.005	5.499	11.374	16.602	0.030	-0.315	0.031	0.011	32.439	0.330	9.348	0.326	-0.634	0.193	0.013	-0.777	1.078	0.012
4	Heated Gas	eBOC	-10.554	0.002	55.889	15.939	0.003	-5.489	30.077	23.279	0.044	-0.460	0.043	0.015	90.520	0.281	27.764	0.265	-1.294	0.343	0.013	-0.774	1.078	0.012
4	Heated Gas	eBOC	-10.527	0.003	56.067	16.110	0.005	-5.457	30.251	23.484	0.018	-0.458	0.016	0.005	90.540	0.594	27.437	0.561	-1.289	0.455	0.013	-0.774	1.078	0.012
4	Heated Gas	BOC	-10.983	0.003	30.132	-8.843	0.005	-6.767	4.976	-2.935	0.025	-0.820	0.028	0.010	14.350	0.227	4.331	0.223	-0.247	0.243	0.013	-0.774	1.078	0.012
4	Heated Gas	eBOC	-10.439	0.003	56.162	16.202	0.007	-5.372	30.344	23.654	0.035	-0.469	0.033	0.012	90.662	0.174	27.367	0.158	-1.201	0.337	0.013	-0.774	1.078	0.012
4	Heated Gas	BOC	-10.678	0.002	30.217	-8.762	0.004	-6.479	5.058	-2.562	0.020	-0.825	0.018	0.006	14.829	0.330	4.640	0.323	-0.362	0.156	0.013	-0.775	1.078	0.012
4	Heated Gas	eBOC	-10.375	0.002	53.668	13.802	0.003	-5.396	27.914	21.185	0.040	-0.536	0.037	0.013	80.912	0.287	23.002	0.270	-0.931	0.273	0.013	-0.775	1.078	0.012
4	Heated Gas	BOC	-10.899	0.009	28.741	-10.182	0.023	-6.735	3.620	-4.249	0.050	-0.842	0.028	0.010	10.228	0.227	2.953	0.249	-0.071	0.247	0.013	-0.777	1.078	0.012
4	Equilibrated Gas	BOC 25degC	-10.441	0.002	27.129	-11.733	0.004	-6.362	2.050	-4.635	0.020	-0.079	0.022	0.008	6.244	0.297	2.131	0.299	-0.248	0.453	0.013	-0.777	1.078	0.012
4	Equilibrated Gas	eBOC 25degC	-10.349	0.002	60.439	20.317	0.004	-5.143	34.512	28.846	0.029	0.383	0.027	0.009	106.033	0.368	33.467	0.339	-1.228	0.441	0.013	-0.777	1.078	0.012
4	Equilibrated Gas	eBOC 25degC	-10.927	0.003	60.215	20.101	0.008	-5.691	34.293	28.049	0.040	0.385	0.042	0.015	103.466	0.501	31.506	0.458	-1.363	0.264	0.013	-0.777	1.078	0.012
4	Equilibrated Gas	BOC 25degC	-10.769	0.021	28.770	-10.154	0.045	-6.613	3.648	-3.312	0.066	-0.057	0.036	0.013	10.221	1.833	2.891	1.841	0.428	1.668	0.013	-0.777	1.078	0.012
5	Standard	TV03	3.467	0.004	30.545	-8.446	0.013	6.791	5.459	12.3362	0.033	-0.076	0.023	0.008	15.800	0.227	4.799	0.207	-7.715	0.492	0.012	-0.820	1.028	0.013
5	Standard	CIT Carrara	2.154	0.004	37.413	-1.838	0.015	5.798	12.149	17.6933	0.035	-0.305	0.021	0.007	34.365	0.204	9.683	0.197	-9.049	0.492	0.012	-0.820	1.028	0.013
5	Standard	TV03	3.446	0.010	30.581	-8.412	0.018	6.773	5.494	12.2767	0.035	-0.150	0.028	0.010	15.296	0.186	4.231	0.197	-4.690	0.705	0.012	-0.820	1.028	0.013
5	Standard	CIT Carrara	2.153	0.015	37.381	-1.869	0.020	5.796	12.118	17.6477	0.042	-0.318	0.044	0.016	33.743	0.236	9.137	0.246	-4.390	0.393	0.012	-0.820	1.028	0.013
5	Standard	TV03	3.440	0.014	30.459	-8.529	0.022	6.763	5.375	12.2393	0.048	-0.060	0.023	0.008	15.215	0.216	4.389	0.219	-5.273	0.263	0.012	-0.820	1.028	0.013
5	Standard	CIT Carrara	2.149	0.021	37.380	-1.870	0.034	5.792	12.117	17.6402	0.064	-0.319	0.020	0.007	33.865	0.194	9.259	0.193	-4.242	0.361	0.012	-0.820	1.028	0.013
5	Standard	TV03	3.442	0.017	30.490	-8.499	0.030	6.766	5.405	12.2426	0.058	-0.089	0.038	0.013	15.343	0.228	4.456	0.208	-5.169	0.310	0.013	-0.812	1.028	0.013
5	Standard	CIT Carrara	2.123	0.017	37.319	-1.929	0.027	5.766	12.058	17.5933	0.039	-0.281	0.022	0.008	33.602	0.294	9.120	0.276	-6.091	0.281	0.012	-0.800	1.028	0.013
5	Standard	TV03	3.435	0.015	30.566	-8.426	0.026	6.762	5.479	12.2882	0.044	-0.113	0.041	0.014	15.907	0.244	4.866	0.197	-6.454	0.876	0.012	-0.800	1.028	0.013
5	Standard	TV03	3.457	0.007	30.543	-8.448	0.010	6.782	5.457	12.3132	0.021	-0.086	0.025	0.009	15.794	0.277	4.798	0.256	-6.624	0.508	0.012	-0.800	1.028	0.013
5	Heated Gas	eBOC	-10.719	0.006	58.429	18.383	0.016	-5.527	32.603	25.6749	0.040	-0.491	0.033	0.012	90.826	0.260	23.031	0.250	-11.987	0.900	0.012	-0.800	1.028	0.013
5	Heated Gas	BOC	-10.864	0.002	27.902	-10.989	0.003	-6.702	2.851	-4.96457	0.038	-0.844	0.035	0.012	8.918	0.173	3.189	0.176	-14.909	0.392	0.012	-0.800	1.028	0.013
5	Heated Gas	eBOC	-11.095	0.011	57.889	17.863	0.010	-5.897	32.075	24.7219	0.037	-0.534	0.046	0.016	90.494	0.256	23.766	0.254	-6.741	0.258	0.012	-0.800	1.028	0.013
5	Heated Gas	BOC	-10.670	0.007	31.507	-7.521	0.012	-6.396	6.365	-1.27379	0.020	-0.899	0.019	0.007	17.726	0.303	4.893	0.306	-4.436	0.465	0.012	-0.800	1.028	0.013
5	Heated Gas	eBOC	-10.709	0.018	58.421	18.375	0.032	-5.518	32.595	25.6812	0.058	-0.487	0.019	0.007	91.872	0.162	24.028	0.144	-6.282	0.294	0.012	-0.800	1.028	0.013
5	Heated Gas	BOC	-10.741	0.016	30.231	-8.748	0.027	-6.507	5.121	-2.53386	0.058	-0.831	0.044	0.016	14.417	0.210	4.105	0.246	-6.232	0.510	0.012	-0.800	1.028	0.013
5	Heated Gas	eBOC	-10.749	0.026	58.909	18.845	0.045	-5.539	33.071	26.117	0.063	-0.492	0.028	0.010	93.265	0.197	24.391	0.198	-3.429	0.813	0.012	-0.800	1.028	0.013
5	Heated Gas	BOC	-10.942	0.013	30.157	-8.819	0.025	-6.697	5.049	-2.793	0.047	-0.822	0.024	0.008	14.318	0.188	4.152	0.201	-6.507	0.112	0.012	-0.800	1.028	0.013
5	Heated Gas	eBOC	-10.374	0.016	58.132	18.097	0.029	-5.215	32.314	25.7652	0.040	-0.452	0.016	0.006	91.064	0.306	23.827	0.265	-9.111	0.680	0.012	-0.800	1.028	0.013
5	Heated Gas	BOC	-10.606	0.010	29.988	-8.982	0.017	-6.389	4.885	-2.59119	0.034	-0.779	0.024	0.008	13.670	0.385	3.838	0.359	-9.796	0.568	0.012	-0.800	1.028	0.013
5	Equilibrated Gas	25C BOC	-10.691	0.014	28.139	-10.762	0.044	-5.483	33.621	27.7032	0.045	-0.046	0.021	0.007	9.571	0.466	3.376	0.415	-4.837	0.251	0.012	-0.800	1.028	0.013
5	Equilibrated Gas	25C eBOC	-10.698	0.021	59.529	19.441	0.039	-6.532	3.082	-3.76859	0.059	0.409	0.019	0.007	95.831	0.208	25.596	0.138	-8.654	0.735	0.012	-0.800	1.028	0.013
5	Equilibrated Gas	25C BOC	-10.639	0.007	28.751	-10.172	0.017	-5.471	33.674	27.7055	0.041	-0.043	0.031	0.011	11.516	0.496	4.114	0.473	-6.305	0.265	0.012	-0.800	1.028	0.013
5	Equilibrated Gas	25C eBOC	-10.553	0.024	59.352	19.271	0.052	-5.341	33.503	27.6759	0.086	0.409	0.035	0.012	95.263	0.502	25.405	0.403	-6.655	1.092	0.012	-0.800	1.028	0.013
5	Equilibrated Gas	25C eBOC	-10.615	0.004	58.356	18.313	0.004	-6.561	4.015	-2.90497	0.050	0.453	0.050	0.018	100.438	0.567	32.188	0.534	-7.673	0.288	0.012	-0.800	1.028	0.013
5	Equilibrated Gas	25C BOC	-10.725	0.003	28.668	-10.252	0.006	-5.500	33.580	27.677	0.027	-0.033	0.024	0.009	11.168	0.203	3.930	0.194	-4.117	0.286	0.012	-0.800	1.028	0.013
6	Standard	TV03	3.427	0.008	30.511	-8.479	0.020	6.752	5.425	12.288	0.027	-0.050	0.017	0.006	15.632	0.300	4.701	0.302	-6.509	0.721	0.012	-0.800	1.099	0.014
6	Standard	CIT Carrara	2.161	0.006	37.393	-1.857	0.011	5.804	12.130	17.708	0.035	-0.278	0.024	0.008	34.320	0.326	9.676	0.305	-6.571	0.659	0.012	-0.800	1.099	0.014
6	Standard	TV03	3.449	0.009	30.545	-8.446	0.019	6.774	5.459	12.313	0.054	-0.081	0.036	0.013	15.765	0.310	4.765	0.273	-7.007	0.835	0.012	-0.800	1.099	0.014
6	Standard	CIT Carrara	2.154	0.003	37.376	-1.874	0.013	5.797	12.114	17.679	0.040	-0.283	0.029	0.010	34.455	0.156	9.842	0.162	-7.050	0.373	0.012	-0.800	1.099	0.014
6	Standard	TV03	3.479	0.009	30.545	-8.446	0.015	6.803	5.459	12.357	0.027	-0.067	0.016	0.006	15.967	0.502	4.965	0.470	-5.415	0.549	0.012	-0.800	1.099	0.014
6	Standard	CIT Carrara	2.151	0.011	37.449	-1.803	0.016	5.797	12.185	17.752	0.037	-0.280	0.024	0.009	33.845	0.331	9.104	0.301	-6.569	0.649	0.012	-0.800	1.099	0.014
6	Standard	TV03	3.496	0.013	30.571	-8.421	0.029	6.819	5.485	12.392	0.030	-0.073	0.026	0.009	15.895	0.350	4.842	0.308	-6.954	0.409	0.012	-0.800	1.099	0.014
6	Standard	CIT Carrara	2.189	0.022	37.474	-1.780	0.040	5.833	12.209	17.811	0.075	-0.283	0.027	0.010	34.746	0.545	9.936	0.482	-7.482	0.784	0.012	-0.800	1.099	0.014
6	Standard	TV03	3.452	0.005	30.541	-8.450	0.009	6.777	5.455	12.324	0.039	-0.070	0.033	0.012	16.226	0.676	5.229	0.656	-4.391	1.333	0.012	-0.800	1.099	0.014
6	Standard	CIT Carrera	2.160	0.002	37.424	-1.828	0.006	5.805	12.218	17.736	0.033	-0.279	0.034	0.012	35.634	0.254	10.899	0.249	-2.697	0.142	0.012	-0.800	1.099	0.014
6	Standard	CIT Carrera	2.162	0.003	37.435	-1.817	0.005	5.805	12.198	17.802	0.045	-0.227	0.038	0.014	36.432	0.478	11.657	0.459	-2.768	0.251	0.012	-0.800	1.099	0.014
6	Heated Gas	BOC	-10.606	0.010	29.988	-8.982	0.017	-6.389	4.885	-2.591	0.034	-0.779	0.024	0.008	13.670	0.385	3.838	0.359	-9.796	0.568	0.012	-0.800	1.099	0.014
6	Heated Gas	eBOC	-10.974	0.013	58.384	18.340	0.029	-5.767	32.559	25.394	0.049	-0.473	0.040	0.014	93.871	1.686	25.975	1.580	-6.409	0.403	0.012	-0.800	1.099	0.014
6	Heated Gas	BOC	-10.579	0.007	29.439	-9.510	0.015	-6.383	4.350	-3.164	0.044	-0.837	0.042	0.015	12.573	0.166	3.821	0.145	-8.837	0.460	0.012	-0.800	1.099	0.014
6	Heated Gas	eBOC	-11.165	0.040	57.209	17.209	0.080	-5.985	31.413	24.077	0.092	-0.441	0.042	0.015	91.319	0.775	25.857	0.628	-6.237	1.194	0.012	-0.800	1.099	0.014
6	Heated Gas	BOC	-10.827	0.005	29.934	-9.035	0.006	-6.597	4.831	-2.939	0.033	-0.860	0.031	0.011	14.412	0.307	4.681	0.293	-4.116	0.517	0.012	-0.800	1.099	0.014
6	Heated Gas	BOC	-10.579	0.007	29.439	-9.510	0.015	-6.389	4.885	-2.591	0.044	-0.837	0.042	0.015	13.670	0.166	3.821	0.145	-9.796	0.460	0.012	-0.800	1.099	0.014
6	Equilibrated Gas	25C eBOC	-10.709	0.002	59.474	19.388	0.005	-5.483	33.621	27.703	0.045	-0.046	0.021	0.007	109.530	0.466	3.376	0.415	-3.812	0.251	0.012	-0.800	1.099	0.014
6	Equilibrated Gas	25C BOC	-10.691	0.014	28.139	-10.762	0.044	-6.532	3.082	-3.769	0.059	0.409	0.019	0.007	9.571	0.208	25.596	0.138	-8.654	0.735	0.012	-0.800	1.099	0.014
6	Equilibrated Gas	25C eBOC	-10.698	0.021	59.529	19.441	0.039	-5.471	33.674	27.705	0.041	-0.043	0.031	0.011	95.831	0.496	4.114	0.473	-6.305	0.265	0.012	-0.800	1.099	0.014
6	Equilibrated Gas	25C eBOC	-10.553	0.024	59.352	19.271	0.052	-5.341	33.503	27.676	0.050	0.453	0.050	0.018	95.263	0.567	32.188	0.534	-7.673	0.288	0.012	-0.800	1.099	0.014
6	Equilibrated Gas	25C BOC	-10.758	0.003	29.096	-9.840	0.007	-6.561	4.015	-2.905	0.086	0.409	0.035	0.012	13.224	0.502	25.405	0.403	-1.916	1.092	0.012	-0.800	1.099	0.014
6	Equilibrated Gas	25C eBOC	-10.726	0.001	59.432	19.348	0.007	-5.500	33.580	27.677	0.027	-0.033	0.024	0.009	109.908	0.203	3.930	0.194	-4.117	0.286	0.012	-0.800	1.099	0.014

Table S2 (cont): Standards, Heated Gasses, and Equilibrated Gasses Analyzed During Clumped Isotope Analyses

Measurement			$\delta^{13}C$		$\delta^{18}O$ gas	$\delta^{18}O$ mineral		δ45 raw	δ46 raw	δ47 raw		Δ_{47} raw			δ48 raw		Δ_{48} raw		δ49 raw		CIT	CIT	ARF	ARF
Week	Type	Name	VPDB (‰)	1σ	VSMOW (‰)	PDB (‰)	1σ	(‰)	(‰)	(‰)	1σ	(v. Oz)	1σ	sterror	(v. Oz)	1σ	(v. Oz)	1σ	(v. Oz)	1σ	slope	intercept	slope	intercept
4	Standard	CIT Carrara	2.020	0.003	37.003	-2.233	0.006	5.628	11.700	17.118	0.024	-0.258	0.022	0.008	34.782	0.270	10.986	0.257	-0.737	0.386	0.013	-0.774	1.078	0.012
4	Standard	TV03	3.309	0.002	30.204	-8.775	0.006	6.602	5.077	11.767	0.025	-0.069	0.026	0.009	15.342	0.378	5.111	0.371	-0.868	0.322	0.013	-0.774	1.078	0.012
4	Standard	NBS-19	1.830	0.002	36.346	-2.865	0.003	5.429	11.060	16.239	0.037	-0.295	0.035	0.013	32.827	0.250	10.355	0.247	-0.747	0.553	0.013	-0.774	1.078	0.012
4	Standard	TV03	3.372	0.002	30.305	-8.678	0.006	6.664	5.175	11.912	0.022	-0.085	0.023	0.008	15.601	0.265	5.170	0.261	-0.740	0.238	0.013	-0.774	1.078	0.012
4	Standard	CIT Carrara	1.355	0.002	37.929	-1.342	0.004	5.038	12.601	17.359	0.032	-0.292	0.032	0.011	37.567	0.397	11.905	0.385	-1.102	0.552	0.013	-0.775	1.078	0.012
4	Standard	TV03	3.282	0.001	30.116	-8.859	0.005	6.573	4.991	11.626	0.022	-0.094	0.025	0.009	14.916	0.237	4.860	0.234	-0.834	0.213	0.013	-0.775	1.078	0.012
4	Standard	CIT Carrara	1.962	0.003	36.841	-2.388	0.003	5.569	11.543	16.854	0.021	-0.304	0.023	0.008	33.843	0.264	10.383	0.258	-0.783	0.329	0.013	-0.777	1.078	0.012
4	Standard	TV03	3.205	0.002	29.945	-9.023	0.004	6.495	4.825	11.378	0.019	-0.097	0.019	0.007	14.356	0.289	4.639	0.285	-0.511	0.430	0.013	-0.777	1.078	0.012
4	Standard	NBS-19	1.758	0.010	36.176	-3.028	0.016	5.355	10.894	15.98	0.027	-0.314	0.028	0.010	31.631	0.456	9.517	0.473	-0.668	0.451	0.013	-0.777	1.078	0.012
4	Standard	TV03	3.149	0.001	30.197	-8.781	0.005	6.451	5.070	11.59	0.030	-0.083	0.028	0.010	14.711	0.275	4.499	0.272	-0.516	0.189	0.013	-0.777	1.078	0.012
4	Standard	CIT Carrara	1.893	0.002	36.669	-2.554	0.005	5.499	11.374	16.602	0.030	-0.315	0.031	0.011	32.439	0.330	9.348	0.326	-0.634	0.193	0.013	-0.777	1.078	0.012
4	Heated Gas	eBOC	-10.554	0.002	55.889	15.939	0.003	-5.489	30.077	23.279	0.044	-0.460	0.043	0.015	90.520	0.281	27.764	0.265	-1.294	0.343	0.013	-0.774	1.078	0.012
4	Heated Gas	eBOC	-10.527	0.003	56.067	16.110	0.005	-5.457	30.251	23.484	0.018	-0.458	0.016	0.005	90.540	0.594	27.437	0.561	-1.289	0.455	0.013	-0.774	1.078	0.012
4	Heated Gas	BOC	-10.983	0.003	30.132	-8.843	0.005	-6.767	4.976	-2.935	0.025	-0.820	0.028	0.010	14.350	0.227	4.331	0.223	-0.247	0.243	0.013	-0.774	1.078	0.012
4	Heated Gas	eBOC	-10.439	0.003	56.162	16.202	0.007	-5.372	30.344	23.654	0.035	-0.469	0.033	0.012	90.662	0.174	27.367	0.158	-1.201	0.337	0.013	-0.774	1.078	0.012
4	Heated Gas	BOC	-10.678	0.002	30.217	-8.762	0.004	-6.479	5.058	-2.562	0.020	-0.825	0.018	0.006	14.829	0.330	4.640	0.323	-0.362	0.156	0.013	-0.775	1.078	0.012
4	Heated Gas	eBOC	-10.375	0.002	53.668	13.802	0.003	-5.396	27.914	21.185	0.040	-0.536	0.037	0.013	80.912	0.287	23.002	0.270	-0.931	0.273	0.013	-0.775	1.078	0.012
4	Heated Gas	BOC	-10.899	0.009	28.741	-10.182	0.023	-6.735	3.620	-4.249	0.050	-0.842	0.028	0.010	10.228	0.227	2.953	0.249	-0.071	0.247	0.013	-0.777	1.078	0.012
4	Equilibrated Gas	BOC 25degC	-10.441	0.002	27.129	-11.733	0.004	-6.362	2.050	-4.635	0.020	-0.079	0.022	0.008	6.244	0.297	2.131	0.299	-0.248	0.453	0.013	-0.777	1.078	0.012
4	Equilibrated Gas	eBOC 25degC	-10.349	0.002	60.439	20.317	0.004	-5.143	34.512	28.846	0.029	0.383	0.027	0.009	106.033	0.368	33.467	0.339	-1.228	0.441	0.013	-0.777	1.078	0.012
4	Equilibrated Gas	eBOC 25degC	-10.927	0.003	60.215	20.101	0.008	-5.691	34.293	28.049	0.040	0.385	0.042	0.015	103.466	0.501	31.506	0.458	-1.363	0.264	0.013	-0.777	1.078	0.012
4	Equilibrated Gas	BOC 25degC	-10.769	0.021	28.770	-10.154	0.045	-6.613	3.648	-3.312	0.066	-0.057	0.036	0.013	10.221	1.833	2.891	1.841	0.428	1.668	0.013	-0.777	1.078	0.012
5	Standard	TV03	3.467	0.004	30.545	-8.446	0.013	6.791	5.459	12.3362	0.033	-0.076	0.023	0.008	15.800	0.227	4.799	0.207	-7.715	0.492	0.012	-0.820	1.028	0.013
5	Standard	CIT Carrara	2.154	0.004	37.413	-1.838	0.015	5.798	12.149	17.6933	0.035	-0.305	0.021	0.007	34.365	0.204	9.683	0.197	-9.049	0.492	0.012	-0.820	1.028	0.013
5	Standard	TV03	3.446	0.010	30.581	-8.412	0.018	6.773	5.494	12.2767	0.035	-0.150	0.028	0.010	15.296	0.186	4.231	0.197	-4.690	0.705	0.012	-0.820	1.028	0.013
5	Standard	CIT Carrara	2.153	0.015	37.381	-1.869	0.020	5.796	12.118	17.6477	0.042	-0.318	0.044	0.016	33.743	0.236	9.137	0.246	-4.390	0.393	0.012	-0.820	1.028	0.013
5	Standard	TV03	3.440	0.014	30.459	-8.529	0.022	6.763	5.375	12.2393	0.048	-0.060	0.023	0.008	15.215	0.216	4.389	0.219	-5.273	0.263	0.012	-0.820	1.028	0.013
5	Standard	CIT Carrara	2.149	0.021	37.380	-1.870	0.034	5.792	12.117	17.6402	0.064	-0.319	0.020	0.007	33.865	0.194	9.259	0.193	-4.242	0.361	0.012	-0.820	1.028	0.013
5	Standard	TV03	3.442	0.017	30.490	-8.499	0.030	6.766	5.405	12.2426	0.058	-0.089	0.038	0.013	15.343	0.228	4.456	0.208	-5.169	0.310	0.013	-0.812	1.028	0.013
5	Standard	CIT Carrara	2.123	0.017	37.319	-1.929	0.027	5.766	12.058	17.5933	0.039	-0.281	0.022	0.008	33.602	0.294	9.120	0.276	-6.091	0.281	0.012	-0.800	1.028	0.013
5	Standard	TV03	3.435	0.015	30.566	-8.426	0.026	6.762	5.479	12.2882	0.044	-0.113	0.041	0.014	15.907	0.244	4.866	0.197	-6.454	0.876	0.012	-0.800	1.028	0.013
5	Standard	TV03	3.457	0.007	30.543	-8.448	0.010	6.782	5.457	12.3132	0.021	-0.086	0.025	0.009	15.794	0.277	4.798	0.256	-6.624	0.508	0.012	-0.800	1.028	0.013
5	Heated Gas	eBOC	-10.719	0.006	58.429	18.383	0.016	-5.527	32.603	25.6749	0.040	-0.491	0.033	0.012	90.826	0.260	23.031	0.250	-11.987	0.900	0.012	-0.800	1.028	0.013
5	Heated Gas	BOC	-10.864	0.002	27.902	-10.989	0.003	-6.702	2.851	-4.96457	0.038	-0.844	0.035	0.012	8.918	0.173	3.189	0.176	-14.909	0.392	0.012	-0.800	1.028	0.013
5	Heated Gas	eBOC	-11.095	0.011	57.889	17.863	0.010	-5.897	32.075	24.7219	0.037	-0.534	0.046	0.016	90.494	0.256	23.766	0.254	-6.741	0.258	0.012	-0.800	1.028	0.013
5	Heated Gas	BOC	-10.670	0.007	31.507	-7.521	0.012	-6.396	6.365	-1.27379	0.020	-0.899	0.019	0.007	17.726	0.303	4.893	0.306	-4.436	0.465	0.012	-0.800	1.028	0.013
5	Heated Gas	eBOC	-10.709	0.018	58.421	18.375	0.032	-5.518	32.595	25.6812	0.058	-0.487	0.019	0.007	91.872	0.162	24.028	0.144	-6.282	0.294	0.012	-0.800	1.028	0.013
5	Heated Gas	BOC	-10.741	0.016	30.231	-8.748	0.027	-6.507	5.121	-2.53386	0.058	-0.831	0.044	0.016	14.417	0.210	4.105	0.246	-6.232	0.510	0.012	-0.800	1.028	0.013
5	Heated Gas	eBOC	-10.749	0.026	58.909	18.845	0.045	-5.539	33.071	26.117	0.063	-0.492	0.028	0.010	93.265	0.197	24.391	0.198	-3.429	0.813	0.012	-0.800	1.028	0.013
5	Heated Gas	BOC	-10.942	0.013	30.157	-8.819	0.025	-6.697	5.049	-2.793	0.047	-0.822	0.024	0.008	14.318	0.188	4.152	0.201	-6.507	0.112	0.012	-0.800	1.028	0.013
5	Heated Gas	eBOC	-10.374	0.016	58.132	18.097	0.029	-5.215	32.314	25.7652	0.040	-0.452	0.016	0.006	91.064	0.306	23.827	0.265	-9.111	0.680	0.012	-0.800	1.028	0.013
5	Heated Gas	BOC	-10.606	0.010	29.988	-8.982	0.017	-6.389	4.885	-2.59119	0.034	-0.779	0.024	0.008	13.670	0.385	3.838	0.359	-9.796	0.568	0.012	-0.800	1.028	0.013
5	Equilibrated Gas	25C BOC	-10.691	0.014	28.139	-10.762	0.044	-5.483	33.621	27.7032	0.045	-0.046	0.021	0.007	9.571	0.466	3.376	0.415	-4.837	0.251	0.012	-0.800	1.028	0.013
5	Equilibrated Gas	25C eBOC	-10.698	0.021	59.529	19.441	0.039	-6.532	3.082	-3.76859	0.059	0.409	0.019	0.007	95.831	0.208	25.596	0.138	-8.654	0.735	0.012	-0.800	1.028	0.013
5	Equilibrated Gas	25C BOC	-10.639	0.007	28.751	-10.172	0.017	-5.471	33.674	27.7055	0.041	-0.043	0.031	0.011	11.516	0.496	4.114	0.473	-6.305	0.265	0.012	-0.800	1.028	0.013
5	Equilibrated Gas	25C eBOC	-10.553	0.024	59.352	19.271	0.052	-5.341	33.503	27.6759	0.086	0.409	0.035	0.012	95.263	0.502	25.405	0.403	-6.655	1.092	0.012	-0.800	1.028	0.013
5	Equilibrated Gas	25C eBOC	-10.615	0.004	58.356	18.313	0.004	-6.561	4.015	-2.90497	0.050	0.453	0.050	0.018	100.438	0.567	32.188	0.534	-7.673	0.288	0.012	-0.800	1.028	0.013
5	Equilibrated Gas	25C BOC	-10.725	0.003	28.668	-10.252	0.006	-5.500	33.580	27.677	0.027	-0.033	0.024	0.009	11.168	0.203	3.930	0.194	-4.117	0.286	0.012	-0.800	1.028	0.013
6	Standard	TV03	3.427	0.008	30.511	-8.479	0.020	6.752	5.425	12.288	0.027	-0.050	0.017	0.006	15.632	0.300	4.701	0.302	-6.509	0.721	0.012	-0.800	1.099	0.014
6	Standard	CIT Carrara	2.161	0.006	37.393	-1.857	0.011	5.804	12.130	17.708	0.035	-0.278	0.024	0.008	34.320	0.326	9.676	0.305	-6.571	0.659	0.012	-0.800	1.099	0.014
6	Standard	TV03	3.449	0.009	30.545	-8.446	0.019	6.774	5.459	12.313	0.054	-0.081	0.036	0.013	15.765	0.310	4.765	0.273	-7.007	0.835	0.012	-0.800	1.099	0.014
6	Standard	CIT Carrara	2.154	0.003	37.376	-1.874	0.013	5.797	12.114	17.679	0.040	-0.283	0.029	0.010	34.455	0.156	9.842	0.162	-7.050	0.373	0.012	-0.800	1.099	0.014
6	Standard	TV03	3.479	0.009	30.545	-8.446	0.015	6.803	5.459	12.357	0.027	-0.067	0.016	0.006	15.967	0.502	4.965	0.470	-5.415	0.549	0.012	-0.800	1.099	0.014
6	Standard	CIT Carrara	2.151	0.011	37.449	-1.803	0.016	5.797	12.185	17.752	0.037	-0.280	0.024	0.009	33.845	0.331	9.104	0.301	-6.569	0.649	0.012	-0.800	1.099	0.014
6	Standard	TV03	3.496	0.013	30.571	-8.421	0.029	6.819	5.485	12.392	0.030	-0.073	0.026	0.009	15.895	0.350	4.842	0.308	-6.954	0.409	0.012	-0.800	1.099	0.014
6	Standard	CIT Carrara	2.189	0.022	37.474	-1.780	0.040	5.833	12.209	17.811	0.075	-0.283	0.027	0.010	34.746	0.545	9.936	0.482	-7.482	0.784	0.012	-0.800	1.099	0.014
6	Standard	TV03	3.452	0.005	30.541	-8.450	0.009	6.777	5.455	12.324	0.039	-0.070	0.033	0.012	16.226	0.676	5.229	0.656	-4.391	1.333	0.012	-0.800	1.099	0.014
6	Standard	CIT Carrera	2.160	0.002	37.424	-1.828	0.006	5.805	12.218	17.736	0.033	-0.279	0.034	0.012	35.634	0.254	10.899	0.249	-2.697	0.142	0.012	-0.800	1.099	0.014
6	Standard	CIT Carrera	2.162	0.003	37.435	-1.817	0.005	5.805	12.198	17.802	0.045	-0.227	0.038	0.014	36.432	0.478	11.657	0.459	-2.768	0.251	0.012	-0.800	1.099	0.014
6	Heated Gas	BOC	-10.606	0.010	29.988	-8.982	0.017	-6.389	4.885	-2.591	0.034	-0.779	0.024	0.008	13.670	0.385	3.838	0.359	-9.796	0.568	0.012	-0.800	1.099	0.014
6	Heated Gas	eBOC	-10.974	0.013	58.384	18.340	0.029	-5.767	32.559	25.394	0.049	-0.473	0.040	0.014	93.871	1.686	25.975	1.580	-6.409	0.403	0.012	-0.800	1.099	0.014
6	Heated Gas	BOC	-10.579	0.007	29.439	-9.510	0.015	-6.383	4.350	-3.164	0.044	-0.837	0.042	0.015	12.573	0.166	3.821	0.145	-8.837	0.460	0.012	-0.800	1.099	0.014
6	Heated Gas	eBOC	-11.165	0.040	57.209	17.209	0.080	-5.985	31.413	24.077	0.092	-0.441	0.042	0.015	91.319	0.775	25.857	0.628	-6.237	1.194	0.012	-0.800	1.099	0.014
6	Heated Gas	BOC	-10.827	0.005	29.934	-9.035	0.006	-6.597	4.831	-2.939	0.033	-0.860	0.031	0.011	14.412	0.307	4.681	0.293	-4.116	0.517	0.012	-0.800	1.099	0.014
6	Heated Gas	BOC	-10.579	0.007	29.439	-9.510	0.015	-6.389	4.885	-2.591	0.044	-0.837	0.042	0.015	13.670	0.166	3.821	0.145	-9.796	0.460	0.012	-0.800	1.099	0.014
6	Equilibrated Gas	25C eBOC	-10.709	0.002	59.474	19.388	0.005	-5.483	33.621	27.703	0.045	-0.046	0.021	0.007	109.530	0.466	3.376	0.415	-3.812	0.251	0.012	-0.800	1.099	0.014
6	Equilibrated Gas	25C BOC	-10.691	0.014	28.139	-10.762	0.044	-6.532	3.082	-3.769	0.059	0.409	0.019	0.007	9.571	0.208	25.596	0.138	-8.654	0.735	0.012	-0.800	1.099	0.014
6	Equilibrated Gas	25C eBOC	-10.698	0.021	59.529	19.441	0.039	-5.471	33.674	27.705	0.041	-0.043	0.031	0.011	95.831	0.496	4.114	0.473	-6.305	0.265	0.012	-0.800	1.099	0.014
6	Equilibrated Gas	25C eBOC	-10.553	0.024	59.352	19.271	0.052	-5.341	33.503	27.676	0.050	0.453	0.050	0.018	95.263	0.567	32.188	0.534	-7.673	0.288	0.012	-0.800	1.099	0.014
6	Equilibrated Gas	25C BOC	-10.758	0.003	29.096	-9.840	0.007	-6.561	4.015	-2.905	0.086	0.409	0.035	0.012	13.224	0.502	25.405	0.403	-1.916	1.092	0.012	-0.800	1.099	0.014
6	Equilibrated Gas	25C eBOC	-10.726	0.001	59.432	19.348	0.007	-5.500	33.580	27.677	0.027	-0.033	0.024	0.009	109.908	0.203	3.930	0.194	-4.117	0.286	0.012	-0.800	1.099	0.014

Table S2 (cont): Standards, Heated Gasses, and Equilibrated Gasses Analyzed During Clumped Isotope Analyses

Measurement			$\delta^{13}C$		$\delta^{18}O$ gas	$\delta^{18}O$ mineral		δ45 raw	δ46 raw	δ47 raw		Δ_{47} raw			δ48 raw		Δ_{48} raw		δ49 raw		CIT	CIT	ARF	ARF
Week	Type	Name	VPDB (‰)	1σ	VSMOW (‰)	PDB (‰)	1σ	(‰)	(‰)	(‰)	1σ	(v. Oz)	1σ	sterror	(v. Oz)	1σ	(v. Oz)	1σ	(v. Oz)	1σ	slope	intercept	slope	intercept
7	Standard	CIT Carrera	2.136	0.005	37.574	-1.683	0.013	5.808	12.124	17.625	0.037	-0.470	0.032	0.011	25.225	0.542	0.625	0.528	-0.464	0.204	0.012	-0.834	1.261	0.016
7	Standard	TV03	3.390	0.005	30.627	-8.367	0.011	6.766	5.401	12.14	0.045	-0.234	0.045	0.016	11.637	0.348	0.698	0.327	-0.185	0.454	0.012	-0.834	1.261	0.016
7	Standard	CIT Carrara	2.048	0.004	37.901	-1.369	0.007	5.751	12.016	17.847	0.049	-0.488	0.044	0.016	26.906	0.344	1.636	0.325	-0.558	0.179	0.012	-0.834	1.261	0.016
7	Standard	TV03	3.360	0.007	30.804	-8.197	0.010	6.732	5.403	12.426	0.031	-0.096	0.030	0.010	13.958	0.246	2.668	0.249	-0.281	0.143	0.014	-0.835	1.261	0.016
7	Standard	CIT Carrara	2.179	0.003	37.336	-1.912	0.008	5.801	12.134	17.547	0.045	-0.355	0.037	0.013	30.132	0.260	5.873	0.243	-0.254	0.287	0.014	-0.835	1.261	0.016
7	Standard	TV03	3.423	0.005	30.647	-8.348	0.011	6.778	5.432	12.327	0.039	-0.102	0.040	0.014	13.703	0.224	2.720	0.222	-0.262	0.297	0.014	-0.835	1.261	0.016
7	Standard	CIT Carrara	2.086	0.004	37.730	-1.533	0.009	5.788	12.042	17.89	0.039	-0.316	0.038	0.014	31.135	0.192	6.089	0.174	-0.442	0.320	0.014	-0.835	1.261	0.016
7	Heated Gas	BOC	-11.834	0.004	32.040	-7.008	0.011	-7.423	6.793	-1.92	0.031	-0.897	0.037	0.013	15.316	0.272	1.661	0.265	-1.237	1.649	0.012	-0.834	1.261	0.016
7	Heated Gas	eBOC	-11.189	0.006	33.190	-5.902	0.014	-5.686	31.856	24.812	0.053	-0.877	0.054	0.019	96.716	0.163	4.662	0.156	-0.800	0.222	0.012	-0.834	1.261	0.016
7	Heated Gas	BOC	-11.207	0.002	32.754	-6.320	0.005	-6.813	7.491	-0.531	0.042	-0.822	0.042	0.015	22.664	0.128	7.512	0.130	0.068	0.192	0.012	-0.834	1.261	0.016
7	Heated Gas	BOC	-11.103	0.005	60.649	20.519	0.019	-6.303	7.753	0.329	0.052	-0.453	0.044	0.015	23.345	0.426	21.184	0.376	-0.096	0.163	0.014	-0.835	1.261	0.016
7	Heated Gas	eBOC	-10.992	0.003	32.804	-6.273	0.003	-5.523	31.958	25.172	0.039	-0.823	0.038	0.014	97.939	0.099	4.262	0.096	-1.283	0.180	0.014	-0.835	1.261	0.016
7	Heated Gas	BOC	-11.264	0.004	57.856	17.832	0.008	-7.130	7.480	-0.881	0.024	-0.501	0.027	0.010	22.385	0.392	16.936	0.376	0.044	0.310	0.014	-0.835	1.261	0.016
7	Heated Gas	BOC	-11.061	0.004	60.808	20.672	0.025	-6.578	7.687	-0.075	0.039	-0.472	0.023	0.008	23.020	0.320	20.389	0.265	0.095	0.242	0.014	-0.835	1.261	0.016
7	Heated Gas	eBOC	-10.698	0.004	58.602	18.549	0.009	-5.458	32.681	25.896	0.035	-0.419	0.038	0.014	99.607	0.467	31.111	0.429	-1.266	0.157	0.014	-0.835	1.261	0.016
7	Heated Gas	BOC	-11.269	0.004	33.219	-5.873	0.012	-6.855	7.944	-0.11	0.035	-0.799	0.037	0.013	23.688	0.259	7.615	0.260	-0.274	0.270	0.014	-0.835	1.261	0.016
7	Equilibrated Gas	25degC BOC	-11.034	0.005	28.180	-10.722	0.005	-6.807	3.034	-4.183	0.027	-0.128	0.026	0.009	9.434	0.272	3.336	0.271	0.130	0.365	0.014	-0.835	1.261	0.016
7	Equilibrated Gas	25degC eBOC	-11.133	0.005	56.477	16.505	0.017	-5.937	30.609	24.136	0.040	0.335	0.039	0.014	93.622	0.270	29.626	0.249	-0.555	0.241	0.014	-0.835	1.261	0.016
7	Equilibrated Gas	25degC BOC	-11.152	0.007	29.327	-9.618	0.012	-6.785	2.749	-4.398	0.036	-0.063	0.048	0.017	8.287	0.341	2.412	0.326	-0.023	0.326	0.014	-0.835	1.261	0.016
7	Equilibrated Gas	25degC eBOC	-11.126	0.005	57.926	17.898	0.012	-5.881	32.021	25.651	0.026	0.410	0.029	0.010	87.009	0.254	20.601	0.243	-0.931	0.529	0.014	-0.835	1.261	0.016
8	Standard	TV03	3.429	0.003	30.671	-8.325	0.009	6.801	5.438	12.365	0.035	-0.093	0.035	0.012	13.811	0.223	2.780	0.206	-0.254	0.336	0.014	-0.835	1.174	0.015
8	Standard	CIT Carrara	2.128	0.004	37.469	-1.784	0.005	5.811	12.121	17.675	0.044	-0.311	0.041	0.014	31.105	0.211	6.566	0.207	-0.502	0.233	0.014	-0.835	1.174	0.015
8	Standard	TV03	3.399	0.005	30.677	-8.319	0.009	6.773	5.433	12.34	0.030	-0.094	0.031	0.011	13.899	0.233	2.856	0.224	-0.468	0.172	0.014	-0.835	1.174	0.015
8	Standard	CIT Carrara	2.129	0.003	37.552	-1.704	0.008	5.816	12.152	17.774	0.027	-0.296	0.032	0.011	31.486	0.263	6.776	0.271	-0.334	0.349	0.014	-0.835	1.174	0.015
8	Standard	TV03	3.407	0.003	30.662	-8.334	0.008	6.780	5.436	12.35	0.043	-0.076	0.035	0.012	14.248	0.162	3.231	0.147	-0.191	0.184	0.013	-0.830	1.174	0.015
8	Standard	CIT Carrara	2.133	0.008	37.532	-1.724	0.010	5.816	12.152	17.742	0.047	-0.308	0.048	0.017	31.979	0.290	7.297	0.270	-0.285	0.106	0.013	-0.830	1.174	0.015
8	Standard	TV03	3.442	0.003	30.644	-8.351	0.005	6.809	5.416	12.312	0.043	-0.093	0.046	0.016	14.293	0.242	3.309	0.239	-0.568	0.273	0.013	-0.830	1.174	0.015
8	Standard	CIT Carrara	2.128	0.003	37.526	-1.730	0.006	5.811	12.121	17.719	0.032	-0.272	0.035	0.012	32.124	0.255	7.450	0.246	-0.987	0.199	0.013	-0.837	1.174	0.015
8	Heated Gas	eBOC	-11.264	0.004	57.856	17.832	0.008	-7.130	7.480	-0.881	0.024	-0.501	0.027	0.010	83.064	0.392	16.936	0.376	0.044	0.310	0.014	-0.835	1.174	0.015
8	Heated Gas	BOC	-11.061	0.004	60.808	20.672	0.025	-6.578	7.687	-0.075	0.039	-0.472	0.023	0.008	92.816	0.320	20.389	0.265	0.095	0.242	0.014	-0.835	1.174	0.015
8	Heated Gas	eBOC	-10.698	0.004	58.602	18.549	0.009	-5.458	32.681	25.896	0.035	-0.419	0.038	0.014	99.607	0.467	31.111	0.429	-1.266	0.157	0.014	-0.835	1.174	0.015
8	Heated Gas	BOC	-11.269	0.004	33.219	-5.873	0.012	-6.855	7.944	-0.11	0.035	-0.799	0.037	0.013	23.688	0.259	7.615	0.260	-0.274	0.270	0.014	-0.835	1.174	0.015
8	Heated Gas	eBOC	-11.103	0.005	60.649	20.519	0.019	-5.768	34.675	27.479	0.052	-0.453	0.044	0.016	93.338	0.426	21.284	0.376	-0.358	0.694	0.013	-0.830	1.174	0.015
8	Heated Gas	BOC	-11.040	0.003	33.156	-5.934	0.006	-6.643	7.883	0.038	0.027	-0.812	0.029	0.010	23.644	0.370	7.694	0.364	-0.056	0.261	0.013	-0.830	1.174	0.015
8	Heated Gas	eBOC	-11.092	0.004	59.885	19.784	0.017	-5.784	33.931	26.677	0.053	-0.510	0.055	0.019	92.249	0.248	21.736	0.229	-0.319	0.790	0.013	-0.830	1.174	0.015
8	Heated Gas	BOC	-10.798	0.002	32.181	-6.872	0.007	-6.450	6.933	-0.744	0.034	-0.867	0.036	0.013	18.206	0.160	4.232	0.152	0.253	0.665	0.013	-0.837	1.174	0.015
8	Equilibrated Gas	25degC BOC	-11.034	0.005	28.180	-10.722	0.005	-6.807	3.034	-4.183	0.027	-0.128	0.026	0.009	9.434	0.272	3.336	0.271	0.130	0.365	0.014	-0.835	1.261	0.016
8	Equilibrated Gas	25degC eBOC	-11.133	0.005	56.477	16.505	0.017	-5.937	30.609	24.136	0.040	0.335	0.039	0.014	93.622	0.270	29.626	0.249	-0.555	0.241	0.014	-0.835	1.261	0.016
8	Equilibrated Gas	25degC BOC	-11.152	0.007	29.327	-9.618	0.012	-6.785	2.749	-4.398	0.036	-0.063	0.048	0.017	8.287	0.341	2.412	0.326	-0.023	0.326	0.014	-0.835	1.261	0.016
8	Equilibrated Gas	25degC eBOC	-11.126	0.005	57.926	17.898	0.012	-5.881	32.021	25.651	0.026	0.410	0.029	0.010	87.009	0.254	20.601	0.243	-0.931	0.529	0.014	-0.835	1.261	0.016
9	Standard	TV03	3.423	0.005	30.598	-8.395	0.010	6.773	5.433	12.285	0.030	-0.093	0.034	0.012	14.250	0.287	3.357	0.280	-0.468	0.172	0.014	-0.837	1.198	0.015
9	Standard	CIT Carrara	2.128	0.004	37.542	-1.714	0.009	5.816	12.152	17.742	0.049	-0.316	0.051	0.018	32.642	0.202	7.925	0.195	-0.334	0.349	0.013	-0.837	1.198	0.015
9	Standard	TV03	3.430	0.004	30.606	-8.387	0.007	6.797	5.426	12.317	0.042	-0.077	0.042	0.015	14.562	0.143	3.650	0.144	-0.359	0.257	0.014	-0.847	1.198	0.015
9	Standard	CIT Carrara	2.141	0.004	37.540	-1.716	0.007	5.811	12.121	17.767	0.039	-0.302	0.041	0.015	32.573	0.224	7.860	0.214	-0.502	0.233	0.014	-0.847	1.198	0.015
9	Standard	TV03	3.428	0.004	30.658	-8.337	0.009	6.705	5.377	12.384	0.034	-0.060	0.034	0.012	14.613	0.271	3.598	0.262	-0.285	0.283	0.014	-0.863	1.198	0.015
9	Standard	NBS-19	2.033	0.003	37.157	-2.084	0.008	5.720	11.811	17.28	0.045	-0.302	0.050	0.018	31.779	0.228	7.830	0.230	-0.620	0.379	0.014	-0.863	1.198	0.015
9	Standard	TV03	3.393	0.003	30.746	-8.253	0.004	6.766	5.401	12.422	0.041	-0.076	0.041	0.014	15.116	0.202	3.924	0.196	-0.185	0.454	0.015	-0.867	1.198	0.015
9	Standard	CIT Carrara	2.135	0.003	37.537	-1.719	0.006	5.811	12.121	17.793	0.021	-0.269	0.023	0.008	33.001	0.278	8.285	0.271	-0.502	0.233	0.015	-0.867	1.198	0.015
9	Heated Gas	BOC	-11.269	0.004	33.219	-5.873	0.012	-6.855	7.944	-0.10957	0.035	-0.799	0.037	0.013	23.688	0.259	7.615	0.260	-0.274	0.270	0.014	-0.837	1.198	0.015
9	Heated Gas	eBOC	-11.061	0.004	60.808	20.672	0.025	-5.768	34.675	27.4786	0.039	-0.472	0.023	0.008	93.338	0.320	20.389	0.265	-0.358	0.242	0.013	-0.837	1.198	0.015
9	Heated Gas	BOC	-11.040	0.003	33.156	-5.934	0.006	-6.643	7.883	0.03771	0.027	-0.812	0.029	0.010	23.644	0.370	7.694	0.364	-0.056	0.261	0.014	-0.847	1.198	0.015
9	Heated Gas	eBOC	-11.092	0.004	59.885	19.784	0.017	-5.784	33.931	26.6775	0.053	-0.510	0.055	0.019	92.249	0.248	21.736	0.229	-0.319	0.790	0.014	-0.847	1.198	0.015
9	Heated Gas	BOC	-10.798	0.002	32.181	-6.872	0.007	-6.450	6.933	-0.74423	0.034	-0.867	0.036	0.013	18.206	0.160	4.232	0.152	0.253	0.665	0.014	-0.863	1.198	0.015
9	Heated Gas	eBOC	-10.852	0.003	59.455	19.370	0.005	-5.573	33.511	26.5393	0.055	-0.464	0.057	0.020	91.069	0.169	21.461	0.159	-0.989	0.819	0.014	-0.863	1.198	0.015
9	Heated Gas	BOC	-11.128	0.005	34.164	-4.964	0.012	-6.690	8.865	0.89516	0.036	-0.864	0.033	0.012	23.573	0.329	5.663	0.325	0.916	0.864	0.015	-0.867	1.198	0.015
9	Heated Gas	eBOC	-10.792	0.005	59.294	19.215	0.005	-5.523	33.355	26.4237	0.047	-0.480	0.041	0.014	91.588	0.355	22.255	0.333	-0.259	0.704	0.015	-0.867	1.198	0.015
9	Equilibrated Gas	25degC BOC	-11.034	0.005	28.180	-10.722	0.005	-6.807	3.034	-4.18312	0.027	-0.128	0.026	0.009	9.434	0.272	3.336	0.271	0.130	0.365	0.014	-0.835	1.261	0.016
9	Equilibrated Gas	25degC eBOC	-11.133	0.005	56.477	16.505	0.017	-5.937	30.609	24.136	0.040	0.335	0.039	0.014	93.622	0.270	29.626	0.249	-0.555	0.241	0.014	-0.835	1.261	0.016
9	Equilibrated Gas	25degC BOC	-11.152	0.007	29.327	-9.618	0.012	-6.785	2.749	-4.39845	0.036	-0.063	0.048	0.017	8.287	0.341	2.412	0.326	-0.023	0.326	0.014	-0.835	1.261	0.016
9	Equilibrated Gas	25degC eBOC	-11.126	0.005	57.926	17.898	0.012	-5.881	32.021	25.6509	0.026	0.410	0.029	0.010	87.009	0.254	20.601	0.243	-0.931	0.529	0.014	-0.835	1.261	0.016

Table S3: Carbon, Oxygen, and Clumped Isotope Analyses

			Analyses*																			
	Measurement		$\delta^{13}C$		$\delta^{18}O$ gas	$\delta^{18}O$ mineral		δ45 raw	δ46 raw	δ47 raw		Δ_{47} raw			δ48 raw		Δ_{48} raw		δ49 raw		Δ_{47} EGL	Δ_{47} ETF
Week	Type	Name	VPDB (‰)	1σ	VSMOW (‰)	VPDB (‰)	1σ	(‰)	(‰)	(‰)	1σ	(v. Oz)	1σ	sterror	(v. Oz)	1σ	(v. Oz)	1σ	(v. Oz)	1σ	Corrected	Corrected
1	Seed Crystals	UWAI-001	4.388	0.003	31.865	-7.177	0.038	7.668	6.698	14.512	0.058	-0.093	0.039	0.014	22.059	1.296	8.504	1.208	-3.380	1.297	-0.272	0.637
1	Seed Crystals	UWAI-001	4.398	0.005	31.869	-7.173	0.056	7.677	6.702	14.535	0.080	-0.083	0.034	0.012	22.499	2.259	8.931	2.122	-3.738	2.182	-0.262	0.648
1	Experiment Product	UWAI-002	0.978	0.003	30.263	-8.717	0.061	4.424	5.130	9.525	0.075	-0.163	0.027	0.010	18.080	1.649	7.714	1.519	-3.585	1.542	-0.280	0.628
1	Experiment Product	UWAI-008	1.594	0.003	30.229	-8.751	0.007	4.999	5.097	10.078	0.051	-0.116	0.050	0.018	13.570	0.471	3.316	0.462	1.185	0.783	-0.240	0.673
1	Experiment Product	UWAI-009	1.679	0.003	30.168	-8.809	0.007	5.076	5.038	10.114	0.041	-0.102	0.044	0.016	13.808	0.629	3.669	0.616	0.692	0.811	-0.226	0.688
1	Experiment Product	UWAI-010	2.053	0.004	30.483	-8.506	0.004	5.436	5.346	10.792	0.043	-0.102	0.041	0.015	14.654	0.501	3.892	0.490	0.644	0.752	-0.235	0.678
1	Experiment Product	UWAI-011	0.824	0.004	30.477	-8.512	0.005	4.287	5.337	9.588	0.035	-0.106	0.034	0.012	14.601	0.451	3.857	0.438	1.068	0.667	-0.224	0.690
1	Experiment Product	UWAI-012	1.750	0.003	30.435	-8.553	0.006	5.152	5.298	10.455	0.029	-0.097	0.031	0.011	15.228	0.303	4.555	0.296	-0.858	0.464	-0.225	0.689
1	Experiment Product	UWAI-013	2.055	0.003	30.474	-8.515	0.004	5.438	5.337	10.785	0.035	-0.101	0.031	0.011	14.925	0.659	4.177	0.648	-0.055	1.135	-0.234	0.679
1	Experiment Product	UWAI-014	2.639	0.004	30.802	-8.199	0.011	5.995	5.658	11.695	0.066	-0.087	0.053	0.019	15.561	0.688	4.166	0.663	0.374	1.371	-0.231	0.683
1	Experiment Product	UWAI-015	2.447	0.005	30.759	-8.241	0.010	5.815	5.616	11.459	0.039	-0.094	0.030	0.011	15.237	0.621	3.930	0.603	0.624	0.888	-0.235	0.678
1	Experiment Product	UWAI-016	2.713	0.002	31.823	-7.216	0.006	6.099	6.654	12.817	0.036	-0.059	0.033	0.012	18.383	0.427	4.964	0.413	0.571	0.643	-0.217	0.699
1	Experiment Product	UWAI-016	2.753	0.004	31.859	-7.182	0.008	6.138	6.689	12.891	0.029	-0.060	0.032	0.011	18.864	0.638	5.370	0.618	-0.308	1.034	-0.219	0.696
1	Experiment Product	UWAI-017	2.701	0.003	31.788	-7.250	0.005	6.087	6.619	12.771	0.013	-0.069	0.012	0.004	18.175	0.589	4.829	0.571	0.784	0.906	-0.226	0.689
1	Experiment Product	UWAI-017	2.723	0.003	31.779	-7.259	0.010	6.107	6.610	12.774	0.015	-0.091	0.017	0.006	18.132	0.364	4.804	0.346	0.573	0.762	-0.248	0.664
1	Experiment Product	UWAI-018	2.606	0.003	31.891	-7.152	0.009	6.002	6.719	12.794	0.030	-0.046	0.026	0.009	18.955	0.608	5.399	0.586	-0.281	0.851	-0.203	0.714
1	Experiment Product	UWAI-019	2.561	0.004	31.905	-7.138	0.010	5.960	6.733	12.763	0.037	-0.048	0.032	0.011	18.620	0.445	5.041	0.423	0.362	0.773	-0.205	0.712
1	Experiment Product	UWAI-020	0.753	0.004	28.817	-10.109	0.009	4.164	3.720	7.795	0.039	-0.173	0.029	0.010	10.041	0.597	2.569	0.578	0.482	1.228	-0.269	0.641
1	Experiment Product	UWAI-020	0.775	0.002	28.911	-10.019	0.007	4.188	3.811	7.906	0.042	-0.177	0.040	0.014	10.353	0.249	2.695	0.243	0.484	0.255	-0.274	0.634
1	Experiment Product	UWAI-021	1.217	0.003	29.074	-9.862	0.008	4.606	3.971	8.536	0.017	-0.138	0.018	0.006	10.631	0.503	2.652	0.495	0.849	0.721	-0.243	0.669
1	Experiment Product	UWAI-021	1.260	0.003	29.183	-9.756	0.009	4.650	4.078	8.680	0.031	-0.145	0.033	0.012	11.256	0.351	3.059	0.337	-0.125	0.487	-0.252	0.659
1	Seed Crystals	UWAI-022	4.342	0.006	31.815	-7.224	0.071	7.623	6.650	14.434	0.111	-0.076	0.040	0.014	22.760	2.030	9.292	1.869	-4.465	2.154	-0.254	0.657
1	Seed Crystals	UWAI-022	4.356	0.003	31.636	-7.397	0.012	7.630	6.475	14.222	0.022	-0.065	0.022	0.008	17.996	0.619	4.940	0.594	0.200	0.936	-0.240	0.672
2	Seed Crystals	UWAI-001	4.381	0.003	31.867	-7.174	0.016	7.728	6.740	14.687	0.023	0.034	0.022	0.008	21.577	0.202	7.944	0.189	-3.466	0.275	-0.210	0.670
2	Experiment Product	UWAI-004	1.601	0.004	30.630	-8.365	0.005	5.086	5.527	10.648	0.029	-0.063	0.030	0.010	17.843	0.243	6.684	0.247	-3.841	0.376	-0.239	0.640
2	Experiment Product	UWAI-005	1.568	0.003	30.585	-8.408	0.002	5.054	5.484	10.552	0.034	-0.082	0.031	0.011	17.824	0.405	6.751	0.401	-4.274	0.411	-0.257	0.622
2	Experiment Product	UWAI-005	1.518	0.004	30.688	-8.309	0.007	5.011	5.584	10.627	0.047	-0.061	0.041	0.014	17.826	0.218	6.554	0.221	-2.916	0.263	-0.237	0.642
2	Experiment Product	UWAI-005	1.569	0.002	30.553	-8.438	0.007	5.054	5.453	10.581	0.021	-0.023	0.021	0.008	17.576	0.239	6.569	0.246	-2.972	0.227	-0.199	0.681
2	Experiment Product	UWAI-006	1.743	0.002	30.509	-8.481	0.004	5.215	5.411	10.635	0.037	-0.093	0.035	0.013	17.583	0.338	6.660	0.335	-4.867	0.346	-0.269	0.610
2	Experiment Product	UWAI-006	1.785	0.003	30.524	-8.467	0.004	5.255	5.425	10.751	0.014	-0.033	0.018	0.006	17.442	0.245	6.492	0.242	-2.938	0.338	-0.212	0.668
2	Experiment Product	UWAI-007	1.811	0.002	30.552	-8.440	0.003	5.280	5.452	10.778	0.031	-0.059	0.029	0.010	17.382	0.297	6.379	0.291	-4.108	0.335	-0.238	0.642
2	Experiment Product	UWAI-008	1.598	0.004	30.626	-8.369	0.005	5.083	5.523	10.643	0.037	-0.060	0.038	0.013	17.904	0.402	6.752	0.396	-3.232	0.450	-0.237	0.643
2	Experiment Product	UWAI-009	1.739	0.003	30.426	-8.560	0.005	5.208	5.330	10.580	0.043	-0.061	0.044	0.016	17.231	0.217	6.474	0.215	-3.052	0.423	-0.237	0.643
2	Experiment Product	UWAI-010	1.903	0.002	30.650	-8.345	0.005	5.369	5.548	10.977	0.045	-0.047	0.041	0.014	17.935	0.295	6.733	0.290	-3.274	0.214	-0.229	0.651
2	Experiment Product	UWAI-011	1.592	0.002	30.458	-8.530	0.004	5.072	5.360	10.461	0.024	-0.070	0.022	0.008	17.638	0.224	6.815	0.223	-3.248	0.189	-0.243	0.636
2	Experiment Product	UWAI-012	1.779	0.002	30.706	-8.292	0.006	5.255	5.602	10.890	0.056	-0.070	0.051	0.018	18.233	0.238	6.920	0.236	-2.876	0.331	-0.250	0.629
2	Experiment Product	UWAI-013	2.111	0.001	30.814	-8.188	0.005	5.569	5.708	11.346	0.029	-0.045	0.030	0.011	18.424	0.249	6.897	0.250	-2.969	0.189	-0.233	0.646
2	Experiment Product	UWAI-014	2.608	0.003	30.970	-8.038	0.006	6.040	5.861	11.988	0.029	-0.042	0.030	0.011	18.869	0.224	7.031	0.222	-4.409	0.317	-0.241	0.639
2	Experiment Product	UWAI-015	2.491	0.003	31.062	-7.949	0.004	5.933	5.950	11.967	0.032	-0.041	0.028	0.010	19.061	0.168	7.041	0.164	-4.015	0.379	-0.239	0.640
2	Experiment Product	UWAI-016	2.685	0.003	31.951	-7.094	0.008	6.145	6.818	13.112	0.047	0.024	0.039	0.014	21.817	0.202	8.026	0.192	-4.803	0.434	-0.193	0.686
2	Experiment Product	UWAI-018	2.673	0.003	32.119	-6.931	0.004	6.139	6.982	13.258	0.015	0.015	0.012	0.004	22.226	0.320	8.100	0.311	-3.515	0.324	-0.205	0.675
2	Experiment Product	UWAI-019	2.596	0.004	32.111	-6.939	0.004	6.075	6.979	13.165	0.034	0.005	0.033	0.012	22.105	0.393	7.997	0.389	-2.665	0.272	-0.214	0.666
2	Experiment Product	UWAI-019	2.604	0.002	32.116	-6.935	0.003	6.067	6.974	13.176	0.028	0.003	0.027	0.010	22.407	0.205	8.285	0.206	-2.831	0.270	-0.215	0.664
2	Experiment Product	UWAI-020	0.933	0.002	29.294	-9.650	0.005	4.415	4.225	8.607	0.021	-0.120	0.023	0.008	13.493	0.279	4.983	0.274	-3.222	0.223	-0.263	0.616
2	Experiment Product	UWAI-021	1.432	0.002	29.744	-9.217	0.007	4.897	4.664	9.548	0.030	-0.114	0.028	0.010	15.003	0.347	5.600	0.347	-2.738	0.179	-0.272	0.607
2	Seed Crystals	UWAI-022	4.383	0.003	31.920	-7.123	0.018	7.732	6.791	14.732	0.037	0.024	0.040	0.014	22.159	0.372	8.417	0.357	-3.171	0.312	-0.220	0.659
3	Seed Crystals	UWAI-001	4.378	0.009	31.703	-7.333	0.017	7.653	6.540	14.301	0.034	-0.075	0.024	0.009	18.397	0.707	5.206	0.679	-0.736	1.212	-0.243	0.651
3	Experiment Product	UWAI-002	0.917	0.003	30.183	-8.795	0.008	4.364	5.051	9.338	0.038	-0.153	0.029	0.010	13.603	0.527	3.441	0.508	0.410	0.759	-0.263	0.629
3	Experiment Product	UWAI-003	1.309	0.005	30.367	-8.617	0.014	4.737	5.232	9.908	0.043	-0.147	0.040	0.014	14.391	0.600	3.860	0.586	0.079	1.002	-0.264	0.628
3	Experiment Product	UWAI-004	1.614	0.005	30.607	-8.387	0.011	5.030	5.466	10.461	0.053	-0.130	0.041	0.015	14.922	0.520	3.917	0.496	0.535	0.965	-0.254	0.640
3	Experiment Product	UWAI-004	1.645	0.011	30.636	-8.359	0.020	5.060	5.495	10.529	0.076	-0.122	0.049	0.017	15.985	1.117	4.911	1.073	-1.533	1.892	-0.246	0.649
3	Experiment Product	UWAI-005	1.571	0.005	30.514	-8.476	0.013	4.993	5.389	10.351	0.064	-0.126	0.049	0.017	14.839	0.435	3.990	0.411	-0.041	0.537	-0.248	0.646
3	Experiment Product	UWAI-006	1.812	0.007	30.473	-8.515	0.014	5.211	5.336	10.496	0.048	-0.154	0.032	0.011	14.197	0.845	3.459	0.811	0.432	1.308	-0.278	0.613
3	Experiment Product	UWAI-007	1.439	0.006	30.783	-8.217	0.007	4.872	5.637	10.449	0.028	-0.148	0.025	0.009	15.074	0.382	3.726	0.370	0.498	0.698	-0.271	0.620
3	Experiment Product	UWAI-007	1.829	0.006	30.530	-8.461	0.018	5.229	5.392	10.591	0.032	-0.133	0.020	0.007	14.364	0.702	3.514	0.669	0.479	1.378	-0.258	0.635
3	Experiment Product	UWAI-008	1.577	0.004	30.297	-8.685	0.009	4.985	5.163	10.091	0.038	-0.154	0.028	0.010	13.628	0.423	3.241	0.403	0.603	0.703	-0.273	0.617
3	Experiment Product	UWAI-009	1.699	0.006	30.297	-8.685	0.010	5.099	5.164	10.220	0.038	-0.144	0.031	0.011	14.008	0.325	3.616	0.310	0.243	0.806	-0.265	0.627
3	Experiment Product	UWAI-009	1.603	0.008	30.500	-8.490	0.013	5.016	5.361	10.337	0.062	-0.136	0.047	0.017	15.203	0.764	4.405	0.733	-0.958	1.188	-0.258	0.634
3	Experiment Product	UWAI-010	2.199	0.006	30.713	-8.284	0.012	5.581	5.571	11.165	0.043	-0.102	0.037	0.013	15.258	0.678	4.040	0.651	0.086	1.089	-0.234	0.662
3	Experiment Product	UWAI-012	1.808	0.006	30.538	-8.453	0.012	5.209	5.399	10.601	0.044	-0.109	0.031	0.011	14.613	0.573	3.745	0.548	0.098	1.102	-0.234	0.661
3	Experiment Product	UWAI-013	2.140	0.006	30.750	-8.249	0.014	5.444	5.610	11.040	0.252	-0.126	0.053	0.019	15.491	0.718	4.193	0.693	-0.114	1.209	-0.256	0.637
3	Experiment Product	UWAI-014	2.500	0.009	30.891	-8.113	0.018	5.868	5.745	11.611	0.041	-0.125	0.024	0.008	15.934	0.627	4.361	0.590	-0.143	1.105	-0.262	0.630
3	Experiment Product	UWAI-015	2.556	0.009	30.960	-8.047	0.013	5.924	5.812	11.733	0.027	-0.127	0.023	0.008	16.571	0.623	4.856	0.597	-0.875	0.988	-0.265	0.627
3	Experiment Product	UWAI-015	2.541	0.008	30.983	-8.025	0.014	5.910	5.835	11.748	0.056	-0.120	0.042	0.015	16.310	0.772	4.553	0.740	-0.819	1.600	-0.259	0.634
3	Experiment Product	UWAI-016	2.685	0.007	32.124	-6.927	0.006	6.083	6.947	13.086	0.058	-0.064	0.053	0.019	19.194	0.375	5.181	0.363	-0.391	0.759	-0.218	0.680
3	Experiment Product	UWAI-017	2.747	0.004	32.008	-7.038	0.018	6.138	6.834	13.057	0.035	-0.087	0.025	0.009	18.785	0.361	5.001	0.347	0.299	1.009	-0.241	0.654
3	Experiment Product	UWAI-018	2.706	0.007	32.048	-7.000	0.015	6.101	6.873	13.019	0.042	-0.075	0.035	0.012	18.628	0.468	4.770	0.447	0.153	0.763	-0.229	0.668
3	Experiment Product	UWAI-018	2.729	0.007	32.094	-6.956	0.019	6.124	6.918	13.086	0.063	-0.078	0.043	0.015	19.138	0.573	5.182	0.549	-0.439	1.038	-0.232	0.664
3	Experiment Product	UWAI-019	2.627	0.007	32.041	-7.007	0.011	6.026	6.866	12.922	0.039	-0.088	0.035	0.012	18.575	0.570	4.731	0.551	0.260	1.027	-0.241	0.654
3	Experiment Product	UWAI-020	0.777	0.010	28.919	-10.011	0.007	4.190	3.819	7.934	0.045	-0.159	0.038	0.013	10.214	0.537	2.542	0.529	0.084	0.665	-0.252	0.641
3	Experiment Product	UWAI-020	0.560	0.007	29.241	-9.701	0.012	3.998	4.132	8.033	0.034	-0.171	0.026	0.009	11.321	0.660	3.014	0.637	0.001	0.953	-0.266	0.626
3	Seed Crystals	UWAI-022	4.342	0.006	31.815	-7.224	0.071	7.623	6.650	14.434	0.111	-0.076	0.040	0.014	22.760	2.030	9.292	1.869	-4.428	2.543	-0.254	0.657
3	Seed Crystals	UWAI-022	4.396	0.005	31.788	-7.250	0.023	7.672	6.623	14.396	0.029	-0.082	0.014	0.005	17.871	0.608	4.521	0.574	0.605	0.888	-0.252	0.641

Table S3 (cont): Carbon, Oxygen, and Clumped Isotope Analyses

			Analyses*																			
	Measurement		$\delta^{13}C$		$\delta^{18}O$ gas	$\delta^{18}O$ mineral		δ45 raw	δ46 raw	δ47 raw		Δ_{47} raw			δ48 raw		Δ_{48} raw		δ49 raw		Δ_{47} EGL	Δ_{47} ETF
Week	Type	Name	VPDB (‰)	1σ	VSMOW (‰)	VPDB (‰)	1σ	(‰)	(‰)	(‰)	1σ	(v. Oz)	1σ	sterror	(v. Oz)	1σ	(v. Oz)	1σ	(v. Oz)	1σ	Corrected	Corrected
4	Experiment Product	UWAI-003	1.178	0.003	29.968	-9.002	0.006	4.600	4.842	9.387	0.018	-0.142	0.021	0.008	14.080	0.239	4.330	0.234	-0.330	0.198	-0.258	0.658
4	Experiment Product	UWAI-006	1.538	0.002	30.091	-8.883	0.005	4.941	4.963	9.905	0.025	-0.098	0.024	0.009	14.397	0.216	4.401	0.212	-0.390	0.239	-0.220	0.699
4	Experiment Product	UWAI-006	1.554	0.001	30.084	-8.890	0.004	4.956	4.956	9.879	0.031	-0.131	0.030	0.011	14.371	0.287	4.391	0.282	-0.336	0.317	-0.254	0.663
4	Experiment Product	UWAI-017	2.552	0.002	31.523	-7.505	0.006	5.939	6.361	12.349	0.031	-0.070	0.028	0.010	18.420	0.208	5.585	0.196	-0.489	0.247	-0.223	0.696
4	Experiment Product	UWAI-017	2.611	0.002	31.637	-7.395	0.004	5.998	6.472	12.508	0.031	-0.083	0.028	0.010	18.617	0.225	5.558	0.221	-0.284	0.209	-0.238	0.680
4	Experiment Product	UWAI-025	3.356	0.001	31.932	-7.099	0.004	6.408	6.437	12.895	0.036	-0.087	0.039	0.014	18.416	0.418	5.430	0.413	-0.542	0.476	-0.247	0.670
4	Experiment Product	UWAI-026	3.317	0.002	31.958	-7.074	0.007	6.372	6.462	12.912	0.024	-0.081	0.021	0.007	18.651	0.228	5.611	0.215	-0.503	0.235	-0.240	0.677
4	Experiment Product	UWAI-027	3.490	0.002	31.926	-7.105	0.004	6.533	6.432	13.031	0.041	-0.075	0.041	0.014	18.463	0.312	5.487	0.313	-0.359	0.278	-0.237	0.681
4	Experiment Product	UWAI-028	3.631	0.002	31.849	-7.179	0.002	6.663	6.357	13.102	0.031	-0.065	0.030	0.011	18.245	0.290	5.421	0.286	-0.337	0.321	-0.227	0.691
4	Experiment Product	UWAI-029	3.302	0.001	31.850	-7.178	0.005	6.354	6.357	12.762	0.030	-0.085	0.034	0.012	18.348	0.168	5.522	0.162	-0.326	0.259	-0.243	0.674
4	Experiment Product	UWAI-030	3.433	0.001	31.822	-7.205	0.003	6.476	6.330	12.881	0.029	-0.086	0.027	0.010	18.183	0.107	5.414	0.104	-0.516	0.150	-0.245	0.672
4	Experiment Product	UWAI-031	2.594	0.002	31.851	-7.177	0.003	5.692	6.356	12.107	0.030	-0.101	0.032	0.011	18.384	0.283	5.560	0.281	-0.261	0.239	-0.250	0.666
4	Experiment Product	UWAI-032	3.057	0.002	31.886	-7.144	0.004	6.127	6.391	12.575	0.036	-0.069	0.034	0.012	18.556	0.324	5.661	0.324	-0.323	0.185	-0.225	0.693
4	Experiment Product	UWAI-033	2.731	0.002	31.822	-7.205	0.004	5.820	6.329	12.176	0.038	-0.088	0.040	0.014	18.288	0.244	5.520	0.243	-0.660	0.265	-0.239	0.678
4	Experiment Product	UWAI-034	2.844	0.002	31.907	-7.123	0.003	5.928	6.412	12.393	0.030	-0.086	0.027	0.010	18.915	0.243	5.974	0.239	-0.613	0.354	-0.239	0.679
4	Experiment Product	UWAI-035	-0.956	0.003	27.536	-11.328	0.005	2.225	2.144	4.180	0.026	-0.227	0.025	0.009	6.277	0.401	1.976	0.394	-0.220	0.211	-0.279	0.635
4	Experiment Product	UWAI-036	1.394	0.002	29.073	-9.850	0.004	4.475	3.647	8.043	0.033	-0.175	0.031	0.011	11.034	0.285	3.700	0.281	-0.439	0.213	-0.274	0.641
4	Experiment Product	UWAI-037	0.844	0.003	28.827	-10.086	0.005	3.953	3.406	7.279	0.029	-0.161	0.032	0.011	10.183	0.337	3.337	0.327	-0.639	0.369	-0.251	0.666
4	Experiment Product	UWAI-038	0.853	0.002	28.792	-10.120	0.005	3.959	3.371	7.255	0.040	-0.157	0.040	0.014	10.074	0.377	3.298	0.374	-0.527	0.411	-0.247	0.670
4	Experiment Product	UWAI-039	1.026	0.003	28.922	-9.995	0.006	4.126	3.499	7.545	0.029	-0.165	0.030	0.011	10.686	0.431	3.650	0.418	-0.732	0.398	-0.259	0.657
4	Experiment Product	UWAI-040	1.767	0.003	29.251	-9.679	0.005	4.830	3.820	8.604	0.040	-0.152	0.040	0.014	11.496	0.312	3.811	0.308	-0.535	0.299	-0.259	0.657
4	Experiment Product	UWAI-041	0.916	0.003	28.881	-10.035	0.007	4.021	3.458	7.405	0.024	-0.157	0.021	0.008	10.413	0.318	3.461	0.304	-0.361	0.391	-0.249	0.668
4	Experiment Product	UWAI-042	0.886	0.003	28.866	-10.049	0.005	3.994	3.444	7.335	0.032	-0.135	0.031	0.011	10.409	0.312	3.486	0.306	-0.547	0.489	-0.227	0.692
4	Experiment Product	UWAI-043	1.088	0.002	28.943	-9.975	0.005	4.185	3.519	7.610	0.030	-0.181	0.035	0.012	10.790	0.498	3.713	0.486	-0.957	0.381	-0.276	0.639
4	Experiment Product	UWAI-044	1.801	0.003	29.392	-9.543	0.002	4.866	3.958	8.793	0.034	-0.138	0.032	0.011	12.070	0.263	4.105	0.259	-0.868	0.258	-0.247	0.670
4	Experiment Product	UWAI-045	2.545	0.002	30.713	-8.272	0.005	5.607	5.248	10.877	0.036	-0.097	0.032	0.011	15.726	0.269	5.149	0.261	-0.742	0.302	-0.232	0.686
4	Experiment Product	UWAI-046	2.362	0.002	30.668	-8.316	0.003	5.435	5.203	10.640	0.016	-0.110	0.013	0.005	15.441	0.191	4.956	0.187	-0.629	0.278	-0.242	0.676
4	Experiment Product	UWAI-047	1.263	0.002	29.090	-9.834	0.002	4.354	3.662	7.955	0.010	-0.153	0.010	0.005	11.381	0.121	4.014	0.119	-1.858	3.258	-0.251	0.666
4	Experiment Product	UWAI-048	1.260	0.002	29.088	-9.835	0.004	4.351	3.661	7.956	0.025	-0.148	0.023	0.008	11.260	0.159	3.896	0.154	-0.822	0.420	-0.246	0.671
5	Experiment Product	UWAI-003	1.368	0.003	30.431	-8.556	0.005	4.886	5.939	10.778	0.042	-0.109	0.039	0.014	16.827	0.396	6.047	0.390	-6.426	0.749	-0.239	0.605
5	Experiment Product	UWAI-023	0.967	0.002	30.094	-8.880	0.007	4.438	5.014	9.379	0.026	-0.153	0.020	0.007	14.604	0.223	4.506	0.221	-6.524	0.406	-0.273	0.615
5	Experiment Product	UWAI-023	0.787	0.013	30.009	-8.962	0.028	4.266	4.931	9.135	0.042	-0.137	0.025	0.009	14.309	0.392	4.380	0.342	-6.202	0.673	-0.254	0.597
5	Experiment Product	UWAI-024	0.934	0.009	29.974	-8.996	0.018	4.403	4.897	9.268	0.041	-0.112	0.023	0.008	13.880	0.236	4.023	0.214	-4.819	0.354	-0.230	0.622
5	Experiment Product	UWAI-024	0.912	0.002	29.986	-8.984	0.005	6.592	6.940	9.285	0.031	-0.086	0.031	0.011	14.779	0.313	4.890	0.304	-5.956	0.367	-0.205	0.640
5	Experiment Product	UWAI-025	3.140	0.014	32.008	-7.039	0.022	6.535	6.884	13.529	0.024	-0.064	0.022	0.008	19.273	0.173	5.384	0.160	-4.449	0.315	-0.237	0.650
5	Experiment Product	UWAI-025	3.230	0.033	32.114	-6.937	0.059	6.623	6.987	13.729	0.095	-0.013	0.029	0.010	20.967	0.783	6.848	0.686	-4.660	1.661	-0.189	0.666
5	Experiment Product	UWAI-025	3.199	0.006	32.065	-6.984	0.009	6.535	6.884	13.528	0.037	-0.064	0.030	0.011	19.782	0.369	5.774	0.367	-4.449	0.315	-0.238	0.650
5	Experiment Product	UWAI-026	3.107	0.013	31.990	-7.056	0.024	6.504	6.866	13.457	0.045	-0.050	0.029	0.010	19.332	0.221	5.478	0.179	-4.409	0.360	-0.222	0.645
5	Experiment Product	UWAI-027	3.299	0.027	32.016	-7.031	0.043	6.684	6.892	13.680	0.060	-0.040	0.036	0.013	19.646	0.384	5.736	0.305	-6.227	0.307	-0.215	0.657
5	Experiment Product	UWAI-027	3.318	0.004	32.051	-6.997	0.008	6.703	6.926	13.750	0.022	-0.025	0.022	0.008	20.078	0.590	6.093	0.571	-3.588	1.102	-0.201	0.654
5	Experiment Product	UWAI-028	3.402	0.013	31.878	-7.164	0.020	6.776	6.757	13.640	0.022	-0.042	0.027	0.010	19.153	0.265	5.518	0.236	-5.585	0.319	-0.217	0.655
5	Experiment Product	UWAI-028	3.451	0.005	32.010	-7.037	0.005	6.826	6.887	13.835	0.029	-0.028	0.024	0.008	20.220	0.557	6.312	0.540	-3.775	0.814	-0.205	0.639
5	Experiment Product	UWAI-029	3.184	0.015	31.946	-7.098	0.025	6.575	6.823	13.497	0.038	-0.042	0.022	0.008	19.361	0.191	5.591	0.177	-4.750	0.168	-0.215	0.659
5	Experiment Product	UWAI-029	3.205	0.005	32.065	-6.983	0.005	6.592	6.940	13.658	0.041	-0.021	0.037	0.013	21.801	0.403	7.765	0.389	-5.956	0.367	-0.209	0.608
5	Experiment Product	UWAI-032	2.939	0.027	32.080	-6.969	0.054	6.350	6.954	13.394	0.082	-0.040	0.032	0.011	20.077	0.413	6.036	0.316	-6.712	0.316	-0.212	0.641
5	Experiment Product	UWAI-033	2.631	0.008	31.967	-7.078	0.014	6.058	6.843	12.953	0.030	-0.068	0.021	0.007	20.010	0.384	6.193	0.363	-7.416	0.362	-0.234	0.621
5	Experiment Product	UWAI-033	2.637	0.003	32.113	-6.938	0.004	6.068	6.985	13.146	0.019	-0.028	0.016	0.006	20.627	0.222	6.517	0.216	-4.239	0.498	-0.196	0.648
5	Experiment Product	UWAI-034	2.680	0.007	32.006	-7.040	0.013	6.105	6.881	13.063	0.039	-0.046	0.029	0.010	19.976	0.512	6.082	0.484	-7.273	0.660	-0.213	0.642
5	Experiment Product	UWAI-034	2.692	0.003	31.995	-7.052	0.007	6.129	6.895	13.082	0.034	-0.027	0.028	0.010	20.718	0.450	6.838	0.432	-7.455	0.645	-0.194	0.650
5	Experiment Product	UWAI-037	0.692	0.025	28.911	-10.019	0.043	4.140	3.860	7.931	0.047	-0.152	0.028	0.010	10.975	0.196	3.216	0.168	-4.602	0.255	-0.253	0.613
5	Experiment Product	UWAI-038	0.698	0.012	28.971	-9.960	0.016	4.148	3.919	7.997	0.030	-0.152	0.034	0.012	11.252	0.218	3.372	0.204	-4.094	0.298	-0.255	0.612
5	Experiment Product	UWAI-038	0.772	0.015	29.099	-9.838	0.024	4.221	4.043	8.176	0.052	-0.171	0.040	0.014	12.120	0.368	3.986	0.332	-6.690	0.337	-0.276	0.577
5	Experiment Product	UWAI-041	0.812	0.019	29.095	-9.841	0.038	4.258	4.040	8.225	0.076	-0.158	0.031	0.011	11.890	0.308	3.763	0.255	-4.677	0.188	-0.272	0.550
5	Experiment Product	UWAI-042	0.849	0.009	29.110	-9.827	0.010	4.293	4.054	8.270	0.026	-0.164	0.011	0.004	11.582	0.253	3.429	0.249	-4.213	0.140	-0.269	0.614
5	Experiment Product	UWAI-042	0.853	0.003	29.068	-9.868	0.007	4.321	4.098	8.338	0.025	-0.137	0.026	0.009	12.720	0.381	4.641	0.370	-6.827	0.502	-0.243	0.600
5	Experiment Product	UWAI-044	1.678	0.022	29.582	-9.373	0.036	5.085	4.516	9.587	0.064	-0.122	0.034	0.012	12.922	0.098	3.835	0.162	-4.511	0.279	-0.245	0.622
5	Experiment Product	UWAI-045	2.397	0.017	30.877	-8.127	0.028	5.802	5.780	11.606	0.054	-0.097	0.019	0.007	16.510	0.175	4.860	0.173	-5.460	0.290	-0.246	0.621

Table S3 (cont): Carbon, Oxygen, and Clumped Isotope Analyses

			Analyses*																			
Measurement			$\delta^{13}C$		$\delta^{18}O$ gas	$\delta^{18}O$ mineral		δ45 raw	δ46 raw	δ47 raw		Δ_{47} raw			δ48 raw		Δ_{48} raw		δ49 raw		Δ_{47} EGL	Δ_{47} ETF
Week	Type	Name	VPDB (‰)	1σ	VSMOW (‰)	VPDB (‰)	1σ	(‰)	(‰)	(‰)	1σ	(v. Oz)	1σ	sterror	(v. Oz)	1σ	(v. Oz)	1σ	(v. Oz)	1σ	Corrected	Corrected
6	Experiment Product	UWAI-030	3.281	0.004	32.072	-6.977	0.005	6.673	6.893	13.651	0.028	0.003	0.025	0.009	20.460	0.400	6.428	0.388	-4.710	0.726	-0.155	0.688
6	Experiment Product	UWAI-035	-1.030	0.003	27.602	-11.278	0.009	2.484	2.581	4.904	0.036	-0.204	0.033	0.012	7.688	0.181	2.507	0.170	-6.361	0.460	-0.271	0.543
6	Experiment Product	UWAI-036	1.273	0.005	29.229	-9.713	0.008	4.694	4.171	8.840	0.024	-0.124	0.024	0.009	12.194	0.198	3.803	0.190	-5.930	0.738	-0.246	0.571
6	Experiment Product	UWAI-037	0.872	0.045	29.250	-9.692	0.089	4.320	4.191	8.404	0.143	-0.192	0.027	0.009	13.123	0.541	4.685	0.386	-7.902	0.724	-0.307	0.521
6	Experiment Product	UWAI-039	0.875	0.007	29.038	-9.896	0.013	4.315	3.984	8.194	0.029	-0.193	0.027	0.010	11.875	0.321	3.859	0.300	-6.660	0.733	-0.309	0.522
6	Experiment Product	UWAI-040	1.683	0.006	29.470	-9.481	0.011	5.086	4.407	9.483	0.046	-0.120	0.033	0.012	13.344	0.319	4.471	0.296	-7.726	0.415	-0.251	0.573
6	Experiment Product	UWAI-041	0.786	0.017	29.024	-9.910	0.032	4.232	3.970	8.141	0.041	-0.146	0.033	0.012	11.278	0.217	3.295	0.205	-4.677	0.188	-0.250	0.616
6	Experiment Product	UWAI-042	0.877	0.012	29.155	-9.784	0.022	4.321	4.098	8.313	0.052	-0.143	0.034	0.012	12.229	0.261	3.983	0.244	-6.827	0.502	-0.258	0.583
6	Experiment Product	UWAI-043	1.052	0.009	29.217	-9.724	0.020	4.487	4.159	8.562	0.052	-0.126	0.034	0.012	12.417	0.288	4.047	0.275	-5.913	0.765	-0.245	0.593
6	Experiment Product	UWAI-044	1.709	0.009	29.608	-9.348	0.016	5.085	4.516	9.533	0.062	-0.114	0.041	0.014	13.677	0.777	4.531	0.745	-4.511	0.279	-0.247	0.566
6	Experiment Product	UWAI-046	2.238	0.004	30.814	-8.187	0.006	5.651	5.719	11.382	0.030	-0.104	0.028	0.010	16.800	0.405	5.270	0.397	-6.990	1.245	-0.261	0.575
6	Experiment Product	UWAI-047	0.962	0.022	29.190	-9.750	0.036	4.402	4.133	8.456	0.056	-0.137	0.024	0.008	11.826	0.128	3.515	0.106	-5.060	0.251	-0.254	0.581
6	Experiment Product	UWAI-048	1.074	0.004	29.264	-9.679	0.009	4.509	4.205	8.667	0.040	-0.139	0.036	0.013	12.299	0.279	3.839	0.261	-6.459	0.249	-0.258	0.565
6	Experiment Product	UWAI-048	1.137	0.009	29.369	-9.578	0.015	4.572	4.308	8.817	0.040	-0.155	0.021	0.008	12.532	0.208	3.865	0.201	-6.426	0.749	-0.277	0.542
7	Experiment Product	UWAI-026	3.082	0.001	32.129	-6.922	0.003	6.529	6.914	13.564	0.025	-0.036	0.027	0.009	20.797	0.324	6.827	0.317	-0.357	0.256	-0.250	0.673
7	Experiment Product	UWAI-031	2.446	0.004	32.058	-6.991	0.010	5.931	6.843	12.858	0.035	-0.061	0.028	0.010	20.714	0.273	6.887	0.268	-0.377	0.182	-0.263	0.657
7	Experiment Product	UWAI-031	2.353	0.004	32.037	-7.010	0.003	5.845	6.823	12.745	0.037	-0.083	0.039	0.014	20.840	0.233	7.052	0.227	-0.250	0.235	-0.284	0.631
7	Experiment Product	UWAI-031	2.397	0.003	32.035	-7.012	0.006	5.885	6.821	12.793	0.050	-0.066	0.049	0.017	20.330	0.244	6.563	0.235	-0.166	0.327	-0.267	0.651
7	Experiment Product	UWAI-032	2.803	0.003	32.046	-7.002	0.010	6.265	6.832	13.210	0.014	-0.068	0.023	0.008	20.552	0.260	6.750	0.258	-0.400	0.331	-0.276	0.641
7	Experiment Product	UWAI-032	2.824	0.003	32.072	-6.977	0.004	6.286	6.858	13.246	0.028	-0.026	0.028	0.010	20.970	0.251	7.122	0.248	-0.393	0.175	-0.235	0.692
7	Experiment Product	UWAI-035	-1.128	0.003	27.617	-11.264	0.009	2.437	2.507	4.743	0.058	-0.242	0.058	0.021	7.631	0.297	2.599	0.298	0.055	0.195	-0.317	0.589
7	Experiment Product	UWAI-035	-1.083	0.002	27.657	-11.225	0.006	2.480	2.546	4.841	0.048	-0.227	0.049	0.017	7.892	0.318	2.786	0.319	-0.138	0.278	-0.303	0.606
7	Experiment Product	UWAI-036	1.162	0.002	29.412	-9.536	0.007	4.640	4.262	8.851	0.033	-0.145	0.031	0.011	12.914	0.260	4.336	0.260	-0.225	0.305	-0.285	0.629
7	Experiment Product	UWAI-036	1.219	0.002	29.333	-9.612	0.008	4.692	4.185	8.817	0.044	-0.156	0.044	0.016	12.577	0.303	4.167	0.292	-0.127	0.178	-0.295	0.616
7	Experiment Product	UWAI-039	0.733	0.003	29.397	-9.551	0.008	4.239	4.246	8.401	0.035	-0.129	0.035	0.012	12.709	0.326	4.164	0.313	-0.361	0.277	-0.262	0.658
7	Experiment Product	UWAI-039	0.847	0.003	29.159	-9.780	0.009	4.338	4.014	8.283	0.057	-0.155	0.060	0.021	12.110	0.219	4.043	0.221	-0.153	0.119	-0.286	0.628
7	Experiment Product	UWAI-040	1.563	0.004	29.535	-9.418	0.007	5.019	4.382	9.377	0.021	-0.132	0.021	0.007	13.184	0.142	4.362	0.138	-0.335	0.304	-0.280	0.635
7	Experiment Product	UWAI-040	1.621	0.006	29.568	-9.387	0.008	5.075	4.414	9.486	0.030	-0.112	0.031	0.011	13.306	0.291	4.431	0.296	-0.225	0.182	-0.262	0.658
7	Experiment Product	UWAI-043	0.962	0.003	29.158	-9.781	0.006	4.445	4.013	8.422	0.027	-0.126	0.030	0.010	12.061	0.277	3.987	0.265	-0.177	0.350	-0.259	0.662
7	Experiment Product	UWAI-043	0.987	0.002	29.274	-9.669	0.008	4.472	4.127	8.566	0.036	-0.122	0.042	0.015	12.597	0.260	4.301	0.260	-0.149	0.280	-0.257	0.664
7	Experiment Product	UWAI-045	2.378	0.004	31.006	-8.003	0.011	5.833	5.817	11.705	0.048	-0.067	0.040	0.014	17.531	0.208	5.795	0.200	-0.316	0.257	-0.252	0.671
8	Experiment Product	UWAI-002	1.218	0.003	30.458	-8.530	0.004	4.729	5.281	9.999	0.051	-0.098	0.053	0.019	15.799	0.270	5.162	0.265	-0.397	0.292	-0.250	0.698
8	Experiment Product	UWAI-003	1.474	0.003	30.598	-8.395	0.010	4.973	5.418	10.396	0.027	-0.089	0.023	0.008	16.207	0.314	5.294	0.310	-0.305	0.246	-0.247	0.701
8	Experiment Product	UWAI-011	1.648	0.003	30.607	-8.386	0.006	5.136	5.427	10.541	0.026	-0.121	0.030	0.011	16.380	0.396	5.446	0.389	-0.280	0.172	-0.281	0.661
8	Experiment Product	UWAI-023	0.723	0.003	30.018	-8.953	0.009	4.251	4.851	9.047	0.031	-0.129	0.030	0.011	14.370	0.276	4.606	0.269	-0.366	0.259	-0.267	0.678
8	Experiment Product	UWAI-024	0.690	0.002	29.956	-9.013	0.004	4.218	4.791	8.947	0.037	-0.134	0.034	0.012	14.335	0.263	4.694	0.255	-0.298	0.164	-0.270	0.674
8	Experiment Product	UWAI-027	3.296	0.002	32.089	-6.961	0.008	6.728	6.875	13.703	0.029	-0.044	0.023	0.008	20.791	0.219	6.913	0.210	-0.280	0.148	-0.252	0.695
8	Experiment Product	UWAI-029	3.180	0.004	32.078	-6.971	0.008	6.619	6.865	13.582	0.035	-0.043	0.033	0.012	20.682	0.266	6.825	0.015	-0.350	0.266	-0.249	0.699
8	Experiment Product	UWAI-029	3.178	0.004	32.123	-6.928	0.009	6.618	6.908	13.590	0.033	-0.076	0.030	0.011	20.822	0.252	6.876	0.260	-0.322	0.184	-0.283	0.660
8	Experiment Product	UWAI-033	2.625	0.003	32.131	-6.921	0.005	6.102	6.914	13.102	0.035	-0.035	0.038	0.013	20.590	0.190	6.633	0.187	-0.281	0.233	-0.234	0.716
8	Experiment Product	UWAI-034	2.659	0.002	32.103	-6.947	0.006	6.133	6.888	13.090	0.046	-0.052	0.045	0.016	20.774	0.291	6.868	0.296	-0.351	0.405	-0.251	0.697
8	Experiment Product	UWAI-037	0.699	0.003	29.124	-9.814	0.005	4.198	3.979	8.084	0.028	-0.175	0.032	0.011	11.908	0.336	3.911	0.330	-0.088	0.350	-0.298	0.642
8	Experiment Product	UWAI-038	0.710	0.004	29.078	-9.858	0.007	4.207	3.935	8.035	0.025	-0.190	0.028	0.010	11.963	0.258	4.055	0.256	-0.086	0.208	-0.312	0.625
8	Experiment Product	UWAI-041	0.737	0.002	29.062	-9.874	0.005	4.231	3.919	8.074	0.026	-0.160	0.027	0.009	11.780	0.326	3.906	0.317	0.066	0.121	-0.283	0.659
8	Experiment Product	UWAI-044	1.664	0.003	29.801	-9.162	0.004	5.123	4.642	9.718	0.044	-0.085	0.048	0.017	13.868	0.325	4.532	0.317	-0.351	0.343	-0.234	0.717
8	Experiment Product	UWAI-045	2.366	0.002	31.020	-7.989	0.007	5.821	5.831	11.661	0.026	-0.112	0.027	0.009	17.620	0.365	5.868	0.358	-0.232	0.401	-0.289	0.652
8	Experiment Product	UWAI-046	2.146	0.003	30.818	-8.183	0.005	5.609	5.634	11.290	0.032	-0.068	0.032	0.011	17.011	0.329	5.659	0.321	-0.218	0.191	-0.240	0.710
8	Experiment Product	UWAI-046	2.229	0.002	30.926	-8.079	0.006	5.690	5.740	11.428	0.037	-0.119	0.038	0.013	17.481	0.417	5.912	0.406	-0.269	0.467	-0.293	0.648
8	Experiment Product	UWAI-047	0.939	0.002	29.336	-9.610	0.008	4.430	4.186	8.560	0.050	-0.144	0.047	0.017	12.573	0.130	4.158	0.132	-0.261	0.331	-0.274	0.670
8	Experiment Product	UWAI-048	1.095	0.002	29.407	-9.541	0.007	4.578	4.257	8.742	0.038	-0.185	0.037	0.013	12.649	0.257	4.093	0.255	-0.243	0.278	-0.318	0.618
9	Experiment Product	UWAI-028	3.159	0.003	32.038	-7.010	0.006	6.598	6.825	13.523	0.009	-0.040	0.011	0.004	20.592	0.139	6.816	0.135	-0.196	0.265	-0.249	0.716
9	Experiment Product	UWAI-030	3.277	0.002	32.074	-6.975	0.000	6.709	6.861	13.678	0.038	-0.036	0.038	0.013	20.637	0.248	6.789	0.244	-0.363	0.270	-0.242	0.613
9	Experiment Product	UWAI-030	3.304	0.004	32.039	-7.009	0.004	6.733	6.826	13.670	0.041	-0.035	0.041	0.015	20.470	0.162	6.694	0.156	-0.438	0.306	-0.241	0.615

* Error values for individual values represent internal instrument error.

Table S3 (cont): Carbon, Oxygen, and Clumped Isotope Analyses

			Overgrowth by Isotope Dilution**										Overgrowth by Mass Balance**									
	Measurement		$\delta^{13}C$			$\delta^{18}O$ mineral			Δ_{47} Mixing			Acid	$\delta^{13}C$			$\delta^{18}O$ mineral			Δ_{47} Mixing			Acid
Week	Type	Name	VPDB (‰)	+ 2σ	- 2σ	VSMOW (‰)	+ 2σ	- 2σ	Correction	+ 2σ	- 2σ	Corrected	VPDB (‰)	+ 2σ	- 2σ	VSMOW (‰)	+ 2σ	- 2σ	Correction	+ 2σ	- 2σ	Corrected
1	Seed Crystals	UWAI-001	4.388	NA	NA	23.462	NA	NA	NA	NA	NA	0.718	4.388	NA	NA	23.462	NA	NA	NA	NA	NA	0.718
1	Seed Crystals	UWAI-001	4.398	NA	NA	23.466	NA	NA	NA	NA	NA	0.729	4.398	NA	NA	23.466	NA	NA	NA	NA	NA	0.729
1	Experiment Product	UWAI-002	-0.545	-0.013	0.013	21.189	-0.006	0.006	0.613	0.000	0.000	0.694	-0.262	-0.002	0.002	21.316	-0.001	0.001	0.607	0.000	0.000	0.688
1	Experiment Product	UWAI-008	0.393	-0.010	0.010	21.165	-0.006	0.006	0.678	0.000	0.000	0.759	0.412	-0.002	0.003	21.176	-0.001	0.001	0.668	0.000	0.000	0.749
1	Experiment Product	UWAI-009	0.408	-0.011	0.012	21.015	-0.007	0.007	0.701	0.000	0.000	0.782	0.533	-0.002	0.002	21.090	-0.001	0.001	0.690	0.000	0.000	0.771
1	Experiment Product	UWAI-010	0.789	-0.012	0.013	21.380	-0.007	0.007	0.688	0.000	0.000	0.769	1.034	-0.002	0.002	21.518	-0.001	0.001	0.676	0.000	0.000	0.757
1	Experiment Product	UWAI-011	-0.893	-0.016	0.016	21.449	-0.006	0.006	0.704	0.000	0.000	0.785	-0.664	-0.003	0.003	21.534	-0.001	0.001	0.693	0.000	0.000	0.774
1	Experiment Product	UWAI-012	0.360	-0.013	0.014	21.325	-0.007	0.007	0.705	0.000	0.000	0.786	0.332	-0.004	0.004	21.311	-0.002	0.002	0.692	0.000	0.000	0.773
1	Experiment Product	UWAI-013	0.546	-0.017	0.017	21.226	-0.009	0.010	0.692	0.000	0.000	0.773	0.628	-0.004	0.004	21.273	-0.002	0.002	0.676	0.000	0.000	0.757
1	Experiment Product	UWAI-014	1.172	-0.019	0.019	21.570	-0.011	0.011	0.705	0.000	0.000	0.786	1.006	-0.008	0.008	21.475	-0.004	0.004	0.683	0.000	0.000	0.764
1	Experiment Product	UWAI-015	0.408	-0.029	0.030	21.271	-0.016	0.016	0.699	0.000	0.000	0.780	0.552	-0.009	0.009	21.348	-0.005	0.005	0.673	0.000	0.000	0.754
1	Experiment Product	UWAI-016	1.228	-0.019	0.020	23.437	0.000	0.000	0.739	0.000	0.000	0.820	1.479	-0.005	0.005	23.434	0.000	0.000	0.711	0.000	0.000	0.792
1	Experiment Product	UWAI-016	1.304	-0.019	0.020	23.503	0.001	-0.001	0.733	0.000	0.000	0.814	1.549	-0.004	0.004	23.495	0.000	0.000	0.705	0.000	0.000	0.786
1	Experiment Product	UWAI-017	1.215	-0.019	0.020	23.370	0.000	0.000	0.720	0.000	0.000	0.801	1.482	-0.004	0.004	23.373	0.000	0.000	0.693	0.000	0.000	0.774
1	Experiment Product	UWAI-017	1.257	-0.019	0.020	23.353	0.000	0.000	0.672	0.000	0.000	0.753	1.520	-0.004	0.004	23.358	0.000	0.000	0.650	0.000	0.000	0.731
1	Experiment Product	UWAI-018	1.276	-0.016	0.016	23.551	0.001	-0.001	0.759	0.000	0.000	0.840	1.489	-0.003	0.004	23.541	0.000	0.000	0.733	0.000	0.000	0.814
1	Experiment Product	UWAI-019	1.277	-0.015	0.015	23.571	0.001	-0.001	0.753	0.000	0.000	0.834	1.391	-0.004	0.004	23.565	0.000	0.000	0.731	0.000	0.000	0.812
1	Experiment Product	UWAI-020	-1.060	-0.017	0.017	18.959	-0.014	0.014	0.627	0.000	0.000	0.708	-0.938	-0.004	0.004	19.058	-0.003	0.003	0.619	0.000	0.000	0.700
1	Experiment Product	UWAI-020	-1.026	-0.017	0.017	19.098	-0.013	0.014	0.616	0.000	0.000	0.697	-0.905	-0.004	0.004	19.194	-0.003	0.003	0.609	0.000	0.000	0.690
1	Experiment Product	UWAI-021	-0.634	-0.019	0.019	19.109	-0.016	0.017	0.670	0.000	0.000	0.751	-0.474	-0.005	0.005	19.246	-0.004	0.004	0.660	0.000	0.000	0.741
1	Experiment Product	UWAI-021	-0.566	-0.019	0.019	19.282	-0.016	0.016	0.654	0.000	0.000	0.735	-0.408	-0.004	0.004	19.413	-0.004	0.004	0.644	0.000	0.000	0.725
1	Seed Crystals	UWAI-022	4.342	NA	NA	23.413	NA	NA	NA	NA	NA	0.738	4.342	NA	NA	23.413	NA	NA	NA	NA	NA	0.738
1	Seed Crystals	UWAI-022	4.356	NA	NA	23.235	NA	NA	NA	NA	NA	0.753	4.356	NA	NA	23.235	NA	NA	NA	NA	NA	0.753
2	Seed Crystals	UWAI-001	4.381	NA	NA	23.464	NA	NA	NA	NA	NA	0.751	4.381	NA	NA	23.464	NA	NA	NA	NA	NA	0.751
2	Experiment Product	UWAI-004	0.112	-0.015	0.015	21.569	-0.006	0.006	0.630	0.000	0.000	0.711	0.354	-0.003	0.003	21.673	-0.001	0.001	0.620	0.000	0.000	0.701
2	Experiment Product	UWAI-005	-0.005	-0.016	0.016	21.404	-0.007	0.007	0.601	0.000	0.000	0.682	0.213	-0.003	0.003	21.504	-0.001	0.001	0.628	0.000	0.000	0.709
2	Experiment Product	UWAI-005	-0.010	-0.016	0.016	21.514	-0.007	0.007	0.632	0.000	0.000	0.713	0.209	-0.003	0.003	21.608	-0.001	0.001	0.592	0.000	0.000	0.673
2	Experiment Product	UWAI-005	-0.088	-0.016	0.016	21.673	-0.006	0.006	0.693	0.000	0.000	0.774	0.135	-0.003	0.003	21.759	-0.001	0.001	0.622	0.000	0.000	0.703
2	Experiment Product	UWAI-006	0.664	-0.010	0.010	21.492	-0.005	0.005	0.588	0.000	0.000	0.669	0.686	-0.002	0.002	21.503	-0.001	0.001	0.582	0.000	0.000	0.663
2	Experiment Product	UWAI-006	0.563	-0.010	0.010	21.543	-0.005	0.005	0.672	0.000	0.000	0.753	0.586	-0.003	0.003	21.554	-0.001	0.001	0.578	0.000	0.000	0.659
2	Experiment Product	UWAI-007	0.624	-0.011	0.011	21.585	-0.005	0.005	0.634	0.000	0.000	0.715	0.698	-0.002	0.002	21.621	-0.001	0.001	0.593	0.000	0.000	0.674
2	Experiment Product	UWAI-008	0.397	-0.010	0.010	21.729	-0.004	0.004	0.636	0.000	0.000	0.717	0.417	-0.002	0.003	21.737	-0.001	0.001	0.626	0.000	0.000	0.707
2	Experiment Product	UWAI-009	0.437	-0.011	0.012	21.203	-0.006	0.006	0.635	0.000	0.000	0.716	0.561	-0.002	0.002	21.273	-0.001	0.001	0.603	0.000	0.000	0.684
2	Experiment Product	UWAI-010	1.015	-0.012	0.012	21.732	-0.006	0.006	0.647	0.000	0.000	0.728	1.245	-0.002	0.002	21.846	-0.001	0.001	0.653	0.000	0.000	0.734
2	Experiment Product	UWAI-011	0.206	-0.012	0.013	21.480	-0.006	0.006	0.625	0.000	0.000	0.706	0.388	-0.002	0.002	21.563	-0.001	0.001	0.616	0.000	0.000	0.697
2	Experiment Product	UWAI-012	0.400	-0.013	0.014	21.622	-0.006	0.006	0.613	0.000	0.000	0.694	0.372	-0.004	0.004	21.610	-0.002	0.002	0.649	0.000	0.000	0.730
2	Experiment Product	UWAI-013	0.618	-0.016	0.017	21.634	-0.008	0.008	0.638	0.000	0.000	0.719	0.699	-0.004	0.004	21.672	-0.002	0.002	0.609	0.000	0.000	0.690
2	Experiment Product	UWAI-014	1.116	-0.019	0.020	21.877	-0.009	0.009	0.624	-0.001	0.001	0.705	0.946	-0.008	0.008	21.798	-0.004	0.004	0.598	0.000	0.000	0.679
2	Experiment Product	UWAI-015	0.632	-0.027	0.028	21.681	-0.013	0.013	0.622	-0.001	0.001	0.703	0.768	-0.009	0.009	21.744	-0.004	0.004	0.572	0.000	0.000	0.653
2	Experiment Product	UWAI-016	1.177	-0.020	0.020	23.676	0.002	-0.002	0.715	0.000	0.000	0.796	1.431	-0.005	0.005	23.654	0.000	0.000	0.688	0.000	0.000	0.769
2	Experiment Product	UWAI-018	1.392	-0.015	0.016	23.948	0.003	-0.003	0.691	0.000	0.000	0.772	1.597	-0.003	0.003	23.911	0.001	-0.001	0.670	0.000	0.000	0.751
2	Experiment Product	UWAI-019	1.389	-0.014	0.015	23.802	0.002	-0.002	0.675	0.000	0.000	0.756	1.498	-0.004	0.004	23.787	0.000	0.000	0.655	0.000	0.000	0.736
2	Experiment Product	UWAI-019	1.337	-0.015	0.015	23.920	0.002	-0.003	0.671	0.000	0.000	0.752	1.448	-0.004	0.004	23.902	0.001	-0.001	0.652	0.000	0.000	0.733
2	Experiment Product	UWAI-020	-0.790	-0.016	0.016	19.669	-0.012	0.012	0.590	0.000	0.000	0.671	-0.675	-0.004	0.004	19.752	-0.003	0.003	0.583	0.000	0.000	0.664
2	Experiment Product	UWAI-021	-0.293	-0.018	0.018	20.164	-0.012	0.013	0.574	0.000	0.000	0.655	-0.144	-0.004	0.004	20.267	-0.003	0.003	0.565	0.000	0.000	0.646
2	Seed Crystals	UWAI-022	4.383	NA	NA	23.517	NA	NA	NA	NA	NA	0.740	4.383	NA	NA	23.517	NA	NA	NA	NA	NA	0.740
3	Seed Crystals	UWAI-001	4.378	NA	NA	23.301	NA	NA	NA	NA	NA	0.732	4.378	NA	NA	23.301	NA	NA	NA	NA	NA	0.732
3	Experiment Product	UWAI-002	-0.546	-0.013	0.013	20.874	-0.007	0.007	0.614	0.000	0.000	0.695	-0.264	-0.002	0.002	21.020	-0.001	0.001	0.609	0.000	0.000	0.690
3	Experiment Product	UWAI-003	-0.487	0.000	0.038	21.134	-0.009	0.009	0.608	0.000	0.000	0.689	0.039	-0.003	0.003	21.387	-0.001	0.001	0.605	0.000	0.000	0.686
3	Experiment Product	UWAI-004	0.159	-0.015	0.015	21.614	-0.006	0.006	0.630	0.000	0.000	0.711	0.399	-0.003	0.003	21.715	-0.001	0.001	0.620	0.000	0.000	0.701
3	Experiment Product	UWAI-004	0.092	-0.015	0.015	21.604	-0.006	0.006	0.644	0.000	0.000	0.725	0.335	-0.003	0.003	21.706	-0.001	0.001	0.633	0.000	0.000	0.714
3	Experiment Product	UWAI-005	-0.009	-0.016	0.016	21.465	-0.007	0.007	0.638	0.000	0.000	0.719	0.210	-0.003	0.003	21.561	-0.001	0.001	0.680	0.000	0.000	0.761
3	Experiment Product	UWAI-006	0.625	-0.010	0.010	21.564	-0.005	0.005	0.592	0.000	0.000	0.673	0.648	-0.002	0.002	21.575	-0.001	0.001	0.661	0.000	0.000	0.742
3	Experiment Product	UWAI-007	0.650	-0.010	0.011	21.554	-0.005	0.005	0.602	0.000	0.000	0.683	0.724	-0.002	0.002	21.590	-0.001	0.001	0.614	0.000	0.000	0.695
3	Experiment Product	UWAI-007	0.624	-0.011	0.011	21.585	-0.005	0.005	0.624	0.000	0.000	0.705	0.698	-0.002	0.002	21.621	-0.001	0.001	0.624	0.000	0.000	0.705
3	Experiment Product	UWAI-008	0.368	-0.010	0.010	21.262	-0.005	0.006	0.598	0.000	0.000	0.679	0.388	-0.003	0.003	21.272	-0.001	0.001	0.589	0.000	0.000	0.670
3	Experiment Product	UWAI-009	0.296	-0.012	0.012	21.499	-0.005	0.006	0.611	0.000	0.000	0.692	0.425	-0.002	0.002	21.559	-0.001	0.001	0.626	0.000	0.000	0.707
3	Experiment Product	UWAI-009	0.496	-0.011	0.011	21.392	-0.006	0.006	0.622	0.000	0.000	0.703	0.619	-0.002	0.002	21.455	-0.001	0.001	0.613	0.000	0.000	0.694
3	Experiment Product	UWAI-010	0.557	-0.013	0.013	21.635	-0.006	0.006	0.664	0.000	0.000	0.745	0.819	-0.002	0.002	21.756	-0.001	0.001	0.637	0.000	0.000	0.718
3	Experiment Product	UWAI-012	0.404	-0.013	0.014	21.736	-0.006	0.006	0.662	0.000	0.000	0.743	0.376	-0.004	0.004	21.725	-0.002	0.002	0.600	0.000	0.000	0.681
3	Experiment Product	UWAI-013	0.639	-0.016	0.017	21.782	-0.007	0.007	0.623	0.000	0.000	0.704	0.719	-0.004	0.004	21.817	-0.002	0.002	0.623	0.000	0.000	0.704
3	Experiment Product	UWAI-014	0.805	-0.021	0.021	20.989	-0.014	0.014	0.607	0.000	0.000	0.688	0.620	-0.008	0.009	20.864	-0.006	0.006	0.580	0.000	0.000	0.661
3	Experiment Product	UWAI-015	0.601	-0.028	0.029	21.728	-0.012	0.013	0.595	-0.001	0.001	0.676	0.738	-0.009	0.009	21.789	-0.004	0.004	0.586	0.000	0.000	0.667
3	Experiment Product	UWAI-015	0.499	-0.028	0.029	21.888	-0.011	0.011	0.609	-0.001	0.001	0.690	0.640	-0.009	0.009	21.943	-0.003	0.004	0.598	0.000	0.000	0.679
3	Experiment Product	UWAI-016	1.175	-0.020	0.020	24.000	0.004	-0.004	0.704	0.000	0.000	0.785	1.430	-0.005	0.005	23.952	0.001	-0.001	0.678	0.000	0.000	0.759
3	Experiment Product	UWAI-017	1.251	-0.019	0.020	22.806	-0.004	0.004	0.654	0.000	0.000	0.735	1.514	-0.004	0.004	22.856	-0.001	0.001	0.633	0.000	0.000	0.714
3	Experiment Product	UWAI-018	1.450	-0.015	0.015	23.824	0.002	-0.002	0.679	0.000	0.000	0.760	1.651	-0.003	0.003	23.795	0.000	0.000	0.658	0.000	0.000	0.739
3	Experiment Product	UWAI-018	1.491	-0.015	0.015	23.905	0.003	-0.003	0.672	0.000	0.000	0.753	1.689	-0.003	0.003	23.870	0.001	-0.001	0.652	0.000	0.000	0.733
3	Experiment Product	UWAI-019	1.350	-0.014	0.015	23.929	0.003	-0.003	0.654	0.000	0.000	0.735	1.460	-0.004	0.004	23.910	0.001	-0.001	0.635	0.000	0.000	0.716
3	Experiment Product	UWAI-020	-1.023	-0.017	0.017	19.110	-0.013	0.014	0.627	0.000	0.000	0.708	-0.903	-0.004	0.004	19.206	-0.003	0.003	0.619	0.000	0.000	0.700
3	Experiment Product	UWAI-020	-1.348	-0.018	0.018	19.589	-0.012	0.012	0.605	0.000	0.000	0.686	-1.221	-0.004	0.004	19.674	-0.003	0.003	0.597	0.000	0.000	0.678
3	Seed Crystals	UWAI-022	4.342	NA	NA	23.413	NA	NA	NA	NA	NA	0.738	4.342	NA	NA	23.413	NA	NA	NA	NA	0.738	0.738
3	Seed Crystals	UWAI-022	4.396	NA	NA	23.386	NA	NA	NA	NA	NA	0.722	4.396	NA	NA	23.386	NA	NA	NA	NA	0.722	0.722

Table S3 (cont): Carbon, Oxygen, and Clumped Isotope Analyses

			Overgrowth by Isotope Dilution**										Overgrowth by Mass Balance**									
	Measurement		$\delta^{13}C$			$\delta^{18}O$ mineral			Δ_{47} Mixing			Acid	$\delta^{13}C$			$\delta^{18}O$ mineral			Δ_{47} Mixing			Acid
Week	Type	Name	VPDB (‰)	+ 2σ	- 2σ	VSMOW (‰)	+ 2σ	- 2σ	Correction	+ 2σ	- 2σ	Corrected	VPDB (‰)	+ 2σ	- 2σ	VSMOW (‰)	+ 2σ	- 2σ	Correction	+ 2σ	- 2σ	Corrected
4	Experiment Product	UWAI-003	-0.230	-0.018	0.018	21.048	-0.009	0.009	0.655	0.000	0.000	0.736	0.285	-0.002	0.002	21.311	-0.001	0.001	0.647	0.000	0.000	0.728
4	Experiment Product	UWAI-006	0.708	-0.010	0.010	21.438	-0.005	0.005	0.716	0.000	0.000	0.797	0.730	-0.002	0.002	21.450	-0.001	0.001	0.705	0.000	0.000	0.786
4	Experiment Product	UWAI-006	0.733	-0.010	0.010	21.427	-0.005	0.005	0.664	0.000	0.000	0.745	0.755	-0.002	0.002	21.439	-0.001	0.001	0.653	0.000	0.000	0.734
4	Experiment Product	UWAI-017	1.510	-0.018	0.018	23.521	0.001	-0.001	0.731	0.000	0.000	0.812	1.751	-0.004	0.004	23.511	0.000	0.000	0.705	0.000	0.000	0.786
4	Experiment Product	UWAI-017	1.621	-0.017	0.017	23.734	0.002	-0.002	0.702	0.000	0.000	0.783	1.854	-0.004	0.004	23.706	0.000	0.000	0.678	0.000	0.000	0.759
4	Experiment Product	UWAI-025	1.850	-0.025	0.026	23.746	0.003	-0.003	0.723	0.000	0.000	0.804	2.099	-0.008	0.008	23.712	0.001	-0.001	0.653	0.000	0.000	0.734
4	Experiment Product	UWAI-026	1.760	-0.026	0.027	23.808	0.004	-0.004	0.739	0.000	0.000	0.820	1.936	-0.009	0.009	23.781	0.001	-0.001	0.658	0.000	0.000	0.739
4	Experiment Product	UWAI-027	1.652	-0.034	0.036	23.811	0.005	-0.005	0.770	-0.001	0.001	0.851	2.187	-0.009	0.010	23.731	0.001	-0.001	0.609	0.000	0.000	0.690
4	Experiment Product	UWAI-028	2.025	-0.030	0.032	23.581	0.002	-0.002	0.804	-0.002	0.002	0.885	2.156	-0.014	0.015	23.571	0.001	-0.001	0.548	0.001	-0.001	0.629
4	Experiment Product	UWAI-029	1.694	-0.027	0.028	23.546	0.001	-0.001	0.732	-0.002	0.002	0.813	1.908	-0.009	0.009	23.535	0.000	0.000	0.510	0.001	-0.001	0.591
4	Experiment Product	UWAI-030	1.753	-0.030	0.031	23.486	0.001	-0.001	0.721	-0.002	0.002	0.802	1.855	-0.013	0.013	23.482	0.000	0.000	0.494	0.001	-0.001	0.575
4	Experiment Product	UWAI-031	0.574	-0.030	0.031	23.527	0.001	-0.001	0.705	-0.001	0.001	0.786	0.869	-0.008	0.008	23.517	0.000	0.000	0.581	0.000	0.000	0.662
4	Experiment Product	UWAI-032	1.242	-0.029	0.030	23.623	0.002	-0.002	0.772	0.000	0.000	0.853	1.146	-0.014	0.014	23.629	0.001	-0.001	0.704	0.000	0.000	0.785
4	Experiment Product	UWAI-033	1.730	-0.011	0.011	23.451	0.000	0.000	0.712	0.000	0.000	0.793	1.780	-0.003	0.003	23.450	0.000	0.000	0.735	0.000	0.000	0.816
4	Experiment Product	UWAI-034	1.867	-0.011	0.011	23.589	0.001	-0.001	0.713	0.000	0.000	0.794	1.882	-0.003	0.003	23.588	0.000	0.000	0.706	0.000	0.000	0.787
4	Experiment Product	UWAI-035†	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4	Experiment Product	UWAI-036	-0.244	-0.016	0.017	19.228	-0.015	0.015	0.646	0.000	0.000	0.727	-0.208	-0.004	0.004	19.260	-0.004	0.004	0.567	0.000	0.000	0.648
4	Experiment Product	UWAI-037	-0.756	-0.014	0.014	19.132	-0.012	0.012	0.681	0.000	0.000	0.762	-0.683	-0.003	0.003	19.193	-0.003	0.003	0.622	0.000	0.000	0.703
4	Experiment Product	UWAI-038	-0.787	-0.015	0.015	19.045	-0.012	0.013	0.687	0.000	0.000	0.768	-0.615	-0.003	0.003	19.190	-0.003	0.003	0.599	0.000	0.000	0.680
4	Experiment Product	UWAI-039	-0.598	-0.054	0.015	19.179	-0.046	0.013	0.670	0.000	0.001	0.751	-0.558	-0.004	0.004	19.212	-0.003	0.003	0.600	0.000	0.000	0.681
4	Experiment Product	UWAI-040	0.060	0.096	0.019	19.237	0.092	0.019	0.672	0.000	-0.001	0.753	-0.056	-0.006	0.006	19.125	-0.006	0.006	0.639	0.000	0.000	0.720
4	Experiment Product	UWAI-041	-0.614	0.001	0.013	19.241	0.001	0.011	0.685	0.000	0.000	0.766	-0.628	-0.003	0.003	19.229	-0.003	0.003	0.646	0.000	0.000	0.727
4	Experiment Product	UWAI-042	-0.834	-0.141	0.016	19.072	-0.117	0.013	0.717	0.000	0.004	0.798	-0.707	-0.004	0.004	19.177	-0.003	0.003	0.560	0.000	0.000	0.641
4	Experiment Product	UWAI-043	-0.643	-0.107	0.017	19.092	-0.092	0.015	0.644	0.000	0.001	0.725	-0.552	-0.004	0.004	19.171	-0.003	0.003	0.653	0.000	0.000	0.734
4	Experiment Product	UWAI-044	-0.187	-0.081	0.025	19.189	-0.075	0.023	0.694	0.000	-0.001	0.775	-0.129	-0.007	0.007	19.242	-0.007	0.007	0.741	0.000	0.000	0.822
4	Experiment Product	UWAI-045	0.707	-0.393	0.026	21.263	-0.229	0.015	0.728	0.000	0.007	0.809	1.079	-0.006	0.006	21.480	-0.003	0.003	0.627	0.000	0.000	0.708
4	Experiment Product	UWAI-046	0.742	-0.069	0.021	21.393	-0.038	0.011	0.709	0.000	0.001	0.790	0.791	-0.006	0.006	21.420	-0.003	0.003	0.621	0.000	0.000	0.702
4	Experiment Product	UWAI-047	-0.275	-0.033	0.014	19.400	-0.028	0.012	0.682	0.000	0.000	0.763	-0.256	-0.004	0.004	19.416	-0.003	0.003	0.662	0.000	0.000	0.743
4	Experiment Product	UWAI-048	-1.127	-0.723	0.030	18.670	-0.621	0.025	0.691	0.000	0.016	0.772	-0.425	-0.004	0.004	19.273	-0.004	0.004	0.581	0.000	0.000	0.662
5	Experiment Product	UWAI-003	-0.412	-0.018	0.019	21.235	-0.008	0.009	0.572	-0.001	0.000	0.653	0.123	-0.003	0.003	21.477	-0.001	0.001	0.572	0.000	0.000	0.653
5	Experiment Product	UWAI-023	0.368	-0.003	0.003	21.408	-0.001	0.001	0.589	0.000	0.000	0.670	0.412	0.000	0.000	21.430	0.000	0.000	0.604	0.000	0.000	0.685
5	Experiment Product	UWAI-023	0.156	-0.003	0.003	21.309	-0.001	0.001	0.576	0.000	0.000	0.657	0.202	0.000	0.000	21.332	0.000	0.000	0.583	0.000	0.000	0.664
5	Experiment Product	UWAI-024	0.483	-0.001	0.001	21.349	-0.001	0.001	0.607	0.000	0.000	0.688	0.348	0.000	0.000	21.278	0.000	0.000	0.611	0.000	0.000	0.692
5	Experiment Product	UWAI-024	0.457	-0.001	0.001	21.362	-0.001	0.001	0.637	0.000	0.000	0.718	0.322	-0.001	0.001	21.292	0.000	0.000	0.632	0.000	0.000	0.713
5	Experiment Product	UWAI-025	1.316	-0.030	0.031	23.899	0.005	-0.005	0.612	-0.001	0.001	0.693	1.617	-0.009	0.009	23.851	0.001	-0.002	0.608	0.000	0.000	0.689
5	Experiment Product	UWAI-025	1.540	-0.028	0.029	24.158	0.007	-0.008	0.659	0.000	0.000	0.740	1.819	-0.009	0.009	24.084	0.002	-0.002	0.643	0.000	0.000	0.724
5	Experiment Product	UWAI-025	1.462	-0.029	0.030	24.039	0.006	-0.006	0.609	-0.001	0.001	0.690	1.749	-0.009	0.009	23.977	0.002	-0.002	0.608	0.000	0.000	0.689
5	Experiment Product	UWAI-026	1.243	-0.031	0.032	23.854	0.004	-0.005	0.649	0.000	0.000	0.730	1.453	-0.011	0.011	23.824	0.002	-0.002	0.677	0.000	0.000	0.758
5	Experiment Product	UWAI-027	1.064	-0.042	0.043	24.043	0.008	-0.008	0.671	0.000	0.000	0.752	1.716	-0.011	0.012	23.918	0.002	-0.002	0.710	0.000	0.000	0.791
5	Experiment Product	UWAI-027	1.124	-0.041	0.043	24.150	0.009	-0.010	0.621	0.000	0.000	0.702	1.764	-0.011	0.011	24.003	0.003	-0.003	0.704	0.000	0.000	0.785
5	Experiment Product	UWAI-028	1.304	-0.040	0.041	23.628	0.003	-0.003	0.665	0.001	-0.001	0.746	1.476	-0.019	0.019	23.616	0.001	-0.001	0.777	-0.001	0.001	0.858
5	Experiment Product	UWAI-028	1.459	-0.038	0.039	24.041	0.008	-0.009	0.607	0.000	0.000	0.688	1.622	-0.018	0.018	24.005	0.004	-0.004	0.662	0.000	0.000	0.743
5	Experiment Product	UWAI-029	1.403	-0.030	0.031	23.750	0.003	-0.004	0.668	0.000	0.000	0.749	1.640	-0.010	0.010	23.723	0.001	-0.001	0.718	0.000	0.000	0.799
5	Experiment Product	UWAI-029	1.454	-0.029	0.030	24.045	0.006	-0.007	0.641	-0.001	0.001	0.722	1.687	-0.010	0.010	23.994	0.002	-0.002	0.628	0.000	0.000	0.709
5	Experiment Product	UWAI-032	0.962	-0.032	0.033	24.049	0.006	-0.006	0.604	0.000	0.000	0.685	0.858	-0.015	0.015	24.069	0.003	-0.003	0.675	0.000	0.000	0.756
5	Experiment Product	UWAI-033	1.570	-0.011	0.011	23.661	0.001	-0.001	0.582	0.000	0.000	0.663	1.623	-0.003	0.003	23.656	0.000	0.000	0.677	0.000	0.000	0.758
5	Experiment Product	UWAI-033	1.578	-0.011	0.011	23.893	0.002	-0.002	0.646	0.000	0.000	0.727	1.631	-0.003	0.003	23.884	0.001	-0.001	0.616	0.000	0.000	0.697
5	Experiment Product	UWAI-034	1.599	-0.012	0.012	23.729	0.001	-0.001	0.616	0.000	0.000	0.697	1.616	-0.003	0.003	23.727	0.000	0.000	0.714	0.005	-0.009	0.795
5	Experiment Product	UWAI-034	1.618	-0.012	0.012	23.710	0.001	-0.001	0.648	0.000	0.000	0.729	1.635	-0.003	0.003	23.708	0.000	0.000	0.640	0.002	-0.003	0.721
5	Experiment Product	UWAI-037	-0.978	-0.015	0.015	19.233	-0.011	0.012	0.599	0.000	0.000	0.680	-0.901	-0.003	0.003	19.292	-0.003	0.003	0.662	0.000	0.000	0.743
5	Experiment Product	UWAI-038	-1.013	-0.015	0.015	19.286	-0.012	0.012	0.598	0.000	0.001	0.679	-0.833	-0.003	0.003	19.424	-0.002	0.002	0.642	0.000	0.000	0.723
5	Experiment Product	UWAI-038	-0.905	-0.015	0.015	19.471	-0.011	0.011	0.524	-0.001	0.003	0.605	-0.729	-0.003	0.003	19.602	-0.002	0.002	0.444	0.000	0.000	0.525
5	Experiment Product	UWAI-041	-0.801	0.001	0.014	19.427	0.001	0.011	0.539	0.000	0.000	0.620	-0.816	-0.004	0.004	19.415	-0.003	0.003	0.693	0.000	0.000	0.774
5	Experiment Product	UWAI-042	-0.890	-0.143	0.016	19.414	-0.108	0.012	0.574	0.000	0.002	0.655	-0.762	-0.004	0.004	19.511	-0.003	0.003	0.614	0.000	0.000	0.695
5	Experiment Product	UWAI-042	-0.848	-0.141	0.016	19.481	-0.106	0.012	0.570	-0.001	0.003	0.651	-0.721	-0.004	0.004	19.576	-0.003	0.003	0.546	0.000	0.000	0.627
5	Experiment Product	UWAI-044	-0.349	-0.084	0.026	19.545	-0.069	0.021	0.602	0.000	-0.001	0.683	-0.289	-0.007	0.007	19.594	-0.006	0.006	0.688	0.000	0.000	0.769
5	Experiment Product	UWAI-045	0.411	-0.425	0.028	21.562	-0.197	0.013	0.462	-0.001	0.017	0.543	0.813	-0.006	0.006	21.749	-0.003	0.003	0.541	0.000	0.000	0.622

Table S3 (cont): Carbon, Oxygen, and Clumped Isotope Analyses

			Overgrowth by Isotope Dilution**										Overgrowth by Mass Balance**									
	Measurement		$\delta^{13}C$			$\delta^{18}O$ mineral			Δ_{47} Mixing			Acid	$\delta^{13}C$			$\delta^{18}O$ mineral			Δ_{47} Mixing			Acid
Week	Type	Name	VPDB (‰)	+ 2σ	- 2σ	VSMOW (‰)	+ 2σ	- 2σ	Correction	+ 2σ	- 2σ	Corrected	VPDB (‰)	+ 2σ	- 2σ	VSMOW (‰)	+ 2σ	- 2σ	Correction	+ 2σ	- 2σ	Corrected
6	Experiment Product	UWAI-030	1.332	-0.035	0.036	24.137	0.008	-0.009	0.685	-0.002	0.002	0.766	1.450	-0.015	0.015	24.109	0.004	-0.004	0.499	0.001	-0.001	0.580
6	Experiment Product	UWAI-035	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6	Experiment Product	UWAI-036	-0.432	-0.017	0.017	19.446	-0.014	0.014	0.574	0.000	0.000	0.655	-0.394	-0.004	0.004	19.477	-0.004	0.004	0.578	0.000	0.000	0.659
6	Experiment Product	UWAI-037	-0.715	-0.014	0.014	19.722	-0.010	0.010	0.488	0.000	0.000	0.569	-0.643	-0.003	0.003	19.774	-0.002	0.002	0.580	0.000	0.000	0.661
6	Experiment Product	UWAI-039	-0.823	-0.057	0.016	19.330	-0.044	0.012	0.529	0.000	-0.001	0.610	-0.781	-0.004	0.004	19.363	-0.003	0.003	0.636	0.000	0.000	0.717
6	Experiment Product	UWAI-040	-0.078	0.099	0.020	19.575	0.085	0.017	0.557	0.000	0.000	0.638	-0.197	-0.006	0.006	19.472	-0.005	0.006	0.658	0.000	0.000	0.739
6	Experiment Product	UWAI-041	-0.763	0.001	0.014	19.529	0.001	0.010	0.604	0.000	0.003	0.685	-0.778	-0.004	0.004	19.518	-0.003	0.003	0.580	0.000	0.000	0.661
6	Experiment Product	UWAI-042	-0.884	-0.142	0.016	19.352	-0.110	0.013	0.559	0.000	0.001	0.640	-0.756	-0.004	0.004	19.450	-0.003	0.003	0.650	0.000	0.000	0.731
6	Experiment Product	UWAI-043	-0.698	-0.108	0.017	19.487	-0.083	0.013	0.622	0.000	0.001	0.703	-0.605	-0.004	0.004	19.558	-0.003	0.003	0.658	0.000	0.000	0.739
6	Experiment Product	UWAI-044	-0.349	-0.084	0.026	19.545	-0.069	0.021	0.562	-0.001	0.013	0.643	-0.289	-0.007	0.007	19.594	-0.006	0.006	0.572	0.000	0.000	0.653
6	Experiment Product	UWAI-046	0.519	-0.073	0.022	21.632	-0.034	0.010	0.596	0.000	0.000	0.677	0.572	-0.006	0.006	21.656	-0.003	0.003	0.655	0.000	0.000	0.736
6	Experiment Product	UWAI-047	-0.725	-0.036	0.016	19.529	-0.027	0.012	0.608	0.000	0.005	0.689	-0.704	-0.004	0.004	19.545	-0.003	0.003	0.662	0.000	0.000	0.743
6	Experiment Product	UWAI-048	-1.457	-0.766	0.031	18.954	-0.584	0.024	0.479	0.000	0.000	0.560	-0.712	-0.005	0.005	19.522	-0.004	0.004	0.647	0.005	-0.005	0.728
6	Experiment Product	UWAI-048	-1.344	-0.751	0.031	19.138	-0.559	0.023	0.450	0.000	0.000	0.531	-0.615	-0.005	0.005	19.682	-0.003	0.003	0.656	0.001	-0.001	0.737
7	Experiment Product	UWAI-026	1.181	-0.031	0.032	24.194	0.008	-0.008	0.817	-0.001	0.001	0.898	1.395	-0.011	0.011	24.141	0.003	-0.003	0.616	0.000	0.000	0.697
7	Experiment Product	UWAI-031	0.259	-0.032	0.033	23.936	0.004	-0.004	0.764	0.000	0.000	0.845	0.579	-0.009	0.009	23.895	0.001	-0.001	0.707	0.000	0.000	0.788
7	Experiment Product	UWAI-031	0.063	-0.034	0.035	23.893	0.004	-0.004	0.717	-0.001	0.001	0.798	0.398	-0.009	0.009	23.855	0.001	-0.001	0.579	0.000	0.000	0.660
7	Experiment Product	UWAI-031	0.156	-0.033	0.034	23.890	0.004	-0.004	0.717	-0.001	0.001	0.789	0.483	-0.009	0.009	23.852	0.001	-0.001	0.580	0.000	0.000	0.661
7	Experiment Product	UWAI-032	0.640	-0.035	0.036	23.968	0.005	-0.005	0.745	0.000	0.000	0.826	0.526	-0.016	0.016	23.986	0.002	-0.002	0.585	0.000	0.000	0.666
7	Experiment Product	UWAI-032	0.690	-0.034	0.035	24.030	0.006	-0.006	0.848	0.000	0.000	0.929	0.578	-0.016	0.016	24.049	0.003	-0.003	0.628	0.000	0.000	0.709
7	Experiment Product	UWAI-035	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Experiment Product	UWAI-035	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Experiment Product	UWAI-036	-0.603	-0.017	0.018	19.728	-0.013	0.013	0.688	0.000	0.000	0.769	-0.565	-0.005	0.005	19.756	-0.003	0.003	0.656	0.000	0.000	0.737
7	Experiment Product	UWAI-036	-0.515	-0.017	0.018	19.607	-0.013	0.014	0.671	-0.001	0.001	0.752	-0.477	-0.005	0.005	19.637	-0.004	0.004	0.449	0.000	0.000	0.530
7	Experiment Product	UWAI-039	-1.032	-0.059	0.016	19.858	-0.039	0.011	0.723	-0.001	-0.004	0.804	-0.989	-0.004	0.004	19.886	-0.003	0.003	0.495	0.000	0.000	0.576
7	Experiment Product	UWAI-039	-0.864	-0.057	0.016	19.508	-0.042	0.012	0.685	0.000	-0.002	0.766	-0.822	-0.004	0.004	19.539	-0.003	0.003	0.600	0.000	0.000	0.681
7	Experiment Product	UWAI-040	-0.278	0.103	0.021	19.682	0.082	0.017	0.700	0.000	0.000	0.781	-0.402	-0.007	0.007	19.582	-0.005	0.005	0.584	0.000	0.000	0.665
7	Experiment Product	UWAI-040	-0.181	0.101	0.020	19.734	0.081	0.016	0.734	-0.001	0.000	0.815	-0.303	-0.007	0.007	19.636	-0.005	0.005	0.489	0.000	0.000	0.570
7	Experiment Product	UWAI-043	-0.835	-0.111	0.018	19.397	-0.085	0.014	0.728	-0.001	0.002	0.809	-0.741	-0.004	0.004	19.469	-0.003	0.003	0.575	0.000	0.000	0.656
7	Experiment Product	UWAI-043	-0.797	-0.110	0.018	19.573	-0.082	0.013	0.732	-0.001	0.004	0.813	-0.703	-0.004	0.004	19.643	-0.003	0.003	0.477	0.000	0.000	0.558
7	Experiment Product	UWAI-045	0.374	-0.429	0.029	21.816	-0.170	0.011	0.765	0.000	0.000	0.846	0.780	-0.006	0.006	21.977	-0.003	0.003	0.670	0.000	0.000	0.751
8	Experiment Product	UWAI-002	-0.198	-0.012	0.012	21.469	-0.005	0.005	0.735	0.000	0.000	0.816	0.065	-0.002	0.002	21.580	-0.001	0.001	0.703	0.000	0.000	0.784
8	Experiment Product	UWAI-003	-0.244	-0.018	0.018	21.499	-0.007	0.008	0.748	0.000	0.000	0.829	0.272	-0.002	0.002	21.711	-0.001	0.001	0.708	0.000	0.000	0.789
8	Experiment Product	UWAI-011	0.328	-0.012	0.012	21.642	-0.005	0.005	0.687	0.000	0.000	0.768	0.504	-0.002	0.002	21.718	-0.001	0.001	0.652	0.000	0.000	0.733
8	Experiment Product	UWAI-023	0.080	-0.003	0.003	21.319	-0.001	0.001	0.700	0.000	0.000	0.781	0.127	0.000	0.000	21.342	0.000	0.000	0.677	0.000	0.000	0.758
8	Experiment Product	UWAI-024	0.228	-0.002	0.002	21.317	-0.001	0.001	0.695	0.000	0.000	0.776	0.085	-0.001	0.001	21.245	0.000	0.000	0.679	0.000	0.000	0.760
8	Experiment Product	UWAI-027	1.056	-0.042	0.043	24.264	0.011	-0.011	0.822	-0.001	0.001	0.903	1.709	-0.011	0.012	24.095	0.003	-0.003	0.596	0.001	-0.001	0.677
8	Experiment Product	UWAI-029	1.392	-0.030	0.031	24.077	0.007	-0.007	0.798	0.000	0.000	0.879	1.630	-0.010	0.010	24.023	0.002	-0.002	0.652	0.000	0.000	0.733
8	Experiment Product	UWAI-029	1.387	-0.030	0.031	24.187	0.008	-0.008	0.709	0.000	0.000	0.790	1.625	-0.010	0.010	24.125	0.003	-0.003	0.693	0.000	0.000	0.774
8	Experiment Product	UWAI-033	1.559	-0.011	0.011	23.921	0.002	-0.002	0.774	0.000	0.000	0.855	1.613	-0.003	0.003	23.911	0.001	-0.001	0.629	0.000	0.000	0.710
8	Experiment Product	UWAI-034	1.564	-0.012	0.012	23.886	0.002	-0.002	0.746	0.000	0.000	0.827	1.581	-0.003	0.003	23.883	0.001	-0.001	0.544	0.002	-0.004	0.625
8	Experiment Product	UWAI-037	-0.967	-0.015	0.015	19.540	-0.010	0.011	0.658	0.000	0.000	0.739	-0.891	-0.003	0.003	19.595	-0.002	0.002	0.531	0.000	0.000	0.612
8	Experiment Product	UWAI-038	-0.996	-0.015	0.015	19.441	-0.011	0.011	0.636	0.000	0.000	0.717	-0.816	-0.003	0.003	19.573	-0.002	0.002	0.644	0.000	0.000	0.725
8	Experiment Product	UWAI-041	-0.872	0.001	0.014	19.480	0.001	0.010	0.681	0.000	0.004	0.762	-0.886	-0.004	0.004	19.469	-0.003	0.003	0.535	0.000	0.000	0.616
8	Experiment Product	UWAI-044	-0.429	-0.086	0.026	19.884	-0.063	0.019	0.779	0.000	0.003	0.860	-0.368	-0.008	0.008	19.929	-0.005	0.006	0.661	0.000	0.000	0.742
8	Experiment Product	UWAI-045	0.349	-0.431	0.029	21.845	-0.167	0.011	0.679	-0.001	0.004	0.760	0.758	-0.006	0.006	22.003	-0.002	0.002	0.491	0.000	0.000	0.572
8	Experiment Product	UWAI-046	0.353	-0.076	0.023	21.640	-0.033	0.010	0.773	-0.001	0.001	0.854	0.408	-0.007	0.007	21.664	-0.003	0.003	0.529	0.000	0.000	0.610
8	Experiment Product	UWAI-046	0.503	-0.073	0.022	21.833	-0.030	0.009	0.672	-0.001	0.001	0.753	0.555	-0.006	0.006	21.854	-0.003	0.003	0.517	0.000	0.000	0.598
8	Experiment Product	UWAI-047	-0.759	-0.036	0.016	19.745	-0.026	0.011	0.696	-0.001	0.034	0.777	-0.739	-0.004	0.004	19.760	-0.003	0.003	0.464	0.000	0.000	0.545
8	Experiment Product	UWAI-048	-1.419	-0.761	0.031	19.205	-0.551	0.023	0.625	0.000	0.000	0.706	-0.679	-0.005	0.005	19.740	-0.003	0.003	0.661	-0.006	-0.001	0.742
9	Experiment Product	UWAI-028	2.025	-0.030	0.032	23.581	0.002	-0.002	0.849	-0.001	0.001	0.930	2.156	-0.014	0.015	23.571	0.001	-0.001	0.626	0.000	0.000	0.707
9	Experiment Product	UWAI-030	1.321	-0.035	0.036	24.142	0.008	-0.009	0.686	0.000	0.000	0.796	1.439	-0.015	0.015	24.113	0.004	-0.004	0.650	0.000	0.000	0.731
9	Experiment Product	UWAI-030	1.395	-0.034	0.035	24.045	0.007	-0.008	0.686	0.000	0.000	0.021	1.511	-0.015	0.015	24.020	0.003	-0.003	0.632	0.000	0.000	0.713

* Error values for individual values represent internal instrument error.
** Overgrowth error values represent propagated uncertainty including overgrowth amount and seed crystal standard deviation about the mean
† Experiment UWAI-035 homogeneously nucleated

Table S4: Carbon, Oxygen, and Clumped Isotope Data Reprocessed with "Brand" Parameters

			Bulk Values								Overgrowth Correction by Isotope Dilution			
	Measurement		$\delta^{13}C$	$\delta^{18}O$ gas	$\delta^{18}O$ gas	$\delta^{18}O$ mineral	Δ_{47} raw	Δ_{48} raw	Δ_{49} raw	Δ_{47} ARF	$\delta^{13}C$	$\delta^{18}O$ mineral	Δ_{47} mixing	Δ_{47} acid
Week	Type	Name	VPDB (‰)	VPDB (‰)	VSMOW (‰)	VSMOW (‰)	(v. Oz)	(v. Oz)	(v. Oz)	Corrected	VPDB (‰)	VSMOW (‰)	Corrected	Corrected
1	Seed Crystals	UWAI-001	4.371	0.975	31.865	23.462	-0.036	8.504	-24.343	0.640	NA	NA	NA	0.722
1	Seed Crystals	UWAI-001	4.381	0.978	31.869	23.466	-0.026	8.931	-24.710	0.651	NA	NA	NA	0.733
1	Experiment Product	UWAI-002	0.969	-0.579	30.263	21.874	-0.105	7.715	-18.183	0.643	-0.547	21.187	0.645	0.727
1	Experiment Product	UWAI-008	1.583	-0.613	30.229	21.839	-0.115	3.316	-14.022	0.622	0.388	21.164	0.615	0.697
1	Experiment Product	UWAI-009	1.668	-0.671	30.168	21.779	-0.101	3.669	-14.474	0.637	0.404	21.014	0.637	0.719
1	Experiment Product	UWAI-010	2.041	-0.366	30.483	22.092	-0.102	3.892	-15.491	0.626	0.785	21.378	0.620	0.702
1	Experiment Product	UWAI-011	0.815	-0.372	30.476	22.085	-0.105	3.857	-13.855	0.641	-0.894	21.447	0.643	0.725
1	Experiment Product	UWAI-012	1.739	-0.413	30.434	22.043	-0.096	4.555	-16.580	0.637	0.357	21.323	0.638	0.720
1	Experiment Product	UWAI-013	2.042	-0.375	30.474	22.083	-0.101	4.177	-16.163	0.627	0.813	21.379	0.622	0.704
1	Experiment Product	UWAI-014	2.625	-0.057	30.802	22.408	-0.086	4.166	-16.938	0.629	1.510	21.764	0.625	0.707
1	Experiment Product	UWAI-015	2.434	-0.098	30.759	22.365	-0.094	3.930	-16.423	0.624	0.409	21.267	0.613	0.695
1	Experiment Product	UWAI-016	2.700	0.935	31.823	23.421	-0.058	4.964	-18.764	0.643	1.227	23.434	0.653	0.735
1	Experiment Product	UWAI-016	2.740	0.969	31.859	23.456	-0.059	5.370	-19.733	0.640	1.299	23.501	0.648	0.730
1	Experiment Product	UWAI-017	2.688	0.900	31.788	23.386	-0.067	4.829	-18.476	0.644	1.214	23.367	0.655	0.737
1	Experiment Product	UWAI-017	2.710	0.891	31.779	23.377	-0.090	4.804	-18.687	0.634	1.255	23.350	0.638	0.720
1	Experiment Product	UWAI-018	2.594	1.000	31.890	23.488	-0.045	5.399	-19.623	0.658	1.273	23.548	0.679	0.761
1	Experiment Product	UWAI-019	2.549	1.013	31.905	23.502	-0.047	5.041	-18.975	0.656	1.274	23.569	0.675	0.757
1	Experiment Product	UWAI-020	0.743	-1.982	28.817	20.439	-0.173	2.569	-11.180	0.593	-1.061	18.957	0.567	0.649
1	Experiment Product	UWAI-020	0.766	-1.891	28.911	20.532	-0.177	2.695	-11.380	0.587	-1.027	19.097	0.557	0.639
1	Experiment Product	UWAI-021	1.206	-1.733	29.074	20.694	-0.138	2.652	-11.767	0.621	-0.659	19.088	0.607	0.689
1	Experiment Product	UWAI-021	1.249	-1.626	29.183	20.803	-0.145	3.059	-12.981	0.611	-0.568	19.280	0.591	0.673
1	Seed Crystals	UWAI-022	4.324	0.927	31.815	23.413	-0.019	9.293	-25.267	0.661	NA	NA	NA	0.743
1	Seed Crystals	UWAI-022	4.339	0.753	31.636	23.235	-0.065	4.940	-20.372	0.612	NA	NA	NA	0.694
2	Seed Crystals	UWAI-001	4.363	0.977	31.868	23.465	0.034	7.944	-24.570	0.632	NA	NA	NA	0.714
2	Experiment Product	UWAI-004	1.590	-0.223	30.630	22.237	-0.062	6.684	-19.887	0.613	0.089	21.602	0.601	0.683
2	Experiment Product	UWAI-005	1.557	-0.267	30.585	22.193	-0.081	6.751	-20.196	0.595	-0.013	21.512	0.571	0.653
2	Experiment Product	UWAI-005	1.508	-0.167	30.688	22.295	-0.060	6.554	-19.007	0.616	-0.090	21.671	0.604	0.686
2	Experiment Product	UWAI-005	1.558	-0.297	30.554	22.162	-0.022	6.569	-18.856	0.657	-0.011	21.463	0.669	0.751
2	Experiment Product	UWAI-006	1.731	-0.340	30.510	22.118	-0.092	6.660	-20.806	0.581	0.558	21.542	0.556	0.638
2	Experiment Product	UWAI-006	1.774	-0.326	30.524	22.132	-0.033	6.492	-18.977	0.642	0.620	21.562	0.645	0.727
2	Experiment Product	UWAI-007	1.799	-0.299	30.552	22.160	-0.058	6.379	-20.206	0.615	0.618	21.584	0.605	0.687
2	Experiment Product	UWAI-008	1.587	-0.227	30.626	22.233	-0.059	6.752	-19.276	0.616	0.393	21.727	0.608	0.690
2	Experiment Product	UWAI-009	1.728	-0.421	30.426	22.036	-0.060	6.474	-18.858	0.616	0.492	21.391	0.607	0.689
2	Experiment Product	UWAI-010	1.891	-0.204	30.650	22.257	-0.046	6.733	-19.662	0.623	0.554	21.634	0.617	0.699
2	Experiment Product	UWAI-011	1.581	-0.390	30.458	22.067	-0.069	6.815	-18.969	0.609	0.241	21.421	0.596	0.678
2	Experiment Product	UWAI-012	1.768	-0.150	30.706	22.313	-0.069	6.920	-19.256	0.601	0.400	21.735	0.583	0.665
2	Experiment Product	UWAI-013	2.099	-0.045	30.814	22.420	-0.044	6.898	-19.876	0.618	0.899	21.895	0.609	0.691
2	Experiment Product	UWAI-014	2.595	0.106	30.970	22.574	-0.041	7.031	-22.072	0.608	1.460	22.038	0.591	0.673
2	Experiment Product	UWAI-015	2.478	0.196	31.062	22.666	-0.040	7.041	-21.746	0.609	0.499	21.885	0.584	0.666
2	Experiment Product	UWAI-016	2.672	1.058	31.951	23.548	0.026	8.026	-24.393	0.656	1.171	23.673	0.678	0.760
2	Experiment Product	UWAI-018	2.660	1.222	32.120	23.715	0.016	8.100	-23.438	0.643	1.389	23.946	0.652	0.734
2	Experiment Product	UWAI-019	2.591	1.219	32.117	23.712	0.005	8.285	-22.532	0.632	1.346	23.927	0.633	0.715
2	Experiment Product	UWAI-019	2.583	1.214	32.111	23.707	0.006	7.997	-22.677	0.634	1.333	23.918	0.637	0.719
2	Experiment Product	UWAI-020	0.923	-1.519	29.295	20.913	-0.120	4.983	-16.076	0.593	-0.791	19.667	0.568	0.650
2	Experiment Product	UWAI-021	1.421	-1.082	29.745	21.359	-0.113	5.600	-16.948	0.581	-0.296	20.162	0.546	0.628
2	Seed Crystals	UWAI-022	4.365	1.028	31.920	23.517	0.024	8.417	-24.382	0.621	NA	NA	NA	0.703
3	Seed Crystals	UWAI-001	4.361	0.817	31.703	23.301	-0.075	5.206	-21.438	0.605	NA	NA	NA	0.687
3	Experiment Product	UWAI-002	0.908	-0.657	30.183	21.794	-0.152	3.441	-14.033	0.597	-0.635	21.072	0.578	0.660
3	Experiment Product	UWAI-003	1.299	-0.478	30.367	21.977	-0.146	3.860	-15.096	0.594	-0.507	21.132	0.567	0.649
3	Experiment Product	UWAI-004	1.603	-0.245	30.607	22.215	-0.129	3.917	-15.405	0.604	0.109	21.568	0.587	0.669
3	Experiment Product	UWAI-004	1.634	-0.217	30.636	22.244	-0.121	4.912	-17.526	0.613	0.156	21.612	0.601	0.683
3	Experiment Product	UWAI-005	1.566	-0.322	30.528	22.136	-0.125	3.990	-15.785	0.611	0.001	21.423	0.597	0.679
3	Experiment Product	UWAI-006	1.801	-0.375	30.473	22.082	-0.153	3.459	-15.445	0.576	0.659	21.490	0.550	0.632
3	Experiment Product	UWAI-007	1.428	-0.075	30.783	22.389	-0.147	3.726	-15.606	0.584	0.076	21.919	0.560	0.642
3	Experiment Product	UWAI-007	1.818	-0.320	30.530	22.138	-0.132	3.514	-15.524	0.599	0.646	21.552	0.582	0.664
3	Experiment Product	UWAI-008	1.566	-0.547	30.297	21.907	-0.154	3.241	-14.708	0.582	0.364	21.260	0.559	0.641
3	Experiment Product	UWAI-009	1.687	-0.546	30.297	21.907	-0.143	3.616	-15.183	0.592	0.433	21.202	0.571	0.653
3	Experiment Product	UWAI-009	1.592	-0.350	30.500	22.108	-0.136	4.405	-16.659	0.599	0.293	21.497	0.582	0.664
3	Experiment Product	UWAI-010	2.187	-0.142	30.713	22.320	-0.101	4.040	-16.623	0.625	1.010	21.731	0.620	0.702
3	Experiment Product	UWAI-012	1.797	-0.313	30.538	22.146	-0.109	3.745	-15.892	0.626	0.444	21.480	0.621	0.703
3	Experiment Product	UWAI-013	2.039	-0.103	30.754	22.360	-0.122	4.193	-16.752	0.603	0.808	21.804	0.586	0.668
3	Experiment Product	UWAI-014	2.487	0.030	30.891	22.496	-0.124	4.361	-17.481	0.591	1.282	21.909	0.564	0.646
3	Experiment Product	UWAI-015	2.543	0.097	30.960	22.565	-0.126	4.856	-18.387	0.588	0.633	21.678	0.538	0.620
3	Experiment Product	UWAI-015	2.528	0.119	30.983	22.588	-0.120	4.553	-18.361	0.594	0.602	21.725	0.553	0.635
3	Experiment Product	UWAI-016	2.672	1.226	32.124	23.719	-0.062	5.181	-20.250	0.639	1.170	23.997	0.647	0.729
3	Experiment Product	UWAI-017	2.734	1.114	32.008	23.605	-0.037	5.001	-19.416	0.670	1.301	23.779	0.704	0.786
3	Experiment Product	UWAI-018	2.693	1.153	32.048	23.644	-0.074	4.770	-19.594	0.627	1.447	23.822	0.624	0.706
3	Experiment Product	UWAI-018	2.716	1.197	32.094	23.690	-0.076	5.182	-20.285	0.623	1.488	23.902	0.617	0.699
3	Experiment Product	UWAI-019	2.614	1.146	32.041	23.637	-0.087	4.731	-19.398	0.613	1.385	23.799	0.601	0.683
3	Experiment Product	UWAI-020	0.768	-1.883	28.919	20.540	-0.158	2.542	-11.793	0.612	-1.024	19.108	0.595	0.677
3	Experiment Product	UWAI-020	0.552	-1.571	29.241	20.859	-0.171	3.014	-12.279	0.596	-1.348	19.587	0.572	0.654
3	Seed Crystals	UWAI-022	4.324	0.927	31.815	23.413	-0.019	9.293	-25.230	0.667	NA	NA	NA	0.749
3	Seed Crystals	UWAI-022	4.379	0.900	31.788	23.386	-0.082	4.521	-20.304	0.595	NA	NA	NA	0.677
4	Experiment Product	UWAI-003	1.168	-0.866	29.968	21.581	-0.141	4.330	-14.606	0.603	-0.223	21.038	0.564	0.646
4	Experiment Product	UWAI-006	1.527	-0.746	30.091	21.703	-0.097	4.401	-15.256	0.645	0.711	21.430	0.632	0.714
4	Experiment Product	UWAI-006	1.543	-0.753	30.084	21.695	-0.131	4.391	-15.203	0.607	0.735	21.419	0.577	0.659
4	Experiment Product	UWAI-017	2.539	0.644	31.524	23.124	-0.069	5.585	-19.077	0.637	1.517	23.509	0.621	0.703
4	Experiment Product	UWAI-017	2.598	0.754	31.637	23.237	-0.082	5.558	-19.149	0.621	1.628	23.722	0.589	0.671
4	Experiment Product	UWAI-025	3.037	0.718	31.600	23.200	-0.086	5.430	-19.761	0.609	1.864	23.729	0.548	0.630
4	Experiment Product	UWAI-026	2.998	0.743	31.626	23.226	-0.057	5.611	-19.734	0.642	1.775	23.791	0.630	0.712
4	Experiment Product	UWAI-027	3.171	0.713	31.595	23.194	-0.075	5.487	-19.702	0.620	1.676	23.789	0.561	0.643
4	Experiment Product	UWAI-028	3.311	0.638	31.518	23.118	-0.064	5.421	-19.671	0.631	2.051	23.559	0.593	0.675
4	Experiment Product	UWAI-029	2.982	0.639	31.518	23.119	-0.084	5.522	-19.341	0.613	1.698	23.530	0.557	0.639
4	Experiment Product	UWAI-030	3.113	0.612	31.490	23.091	-0.065	5.414	-19.601	0.634	1.772	23.466	0.605	0.687
4	Experiment Product	UWAI-031	2.276	0.639	31.519	23.119	-0.050	5.560	-18.586	0.664	0.586	23.512	0.675	0.757
4	Experiment Product	UWAI-032	2.738	0.673	31.554	23.154	-0.069	5.661	-19.166	0.635	1.258	23.606	0.611	0.693
4	Experiment Product	UWAI-033	2.413	0.612	31.491	23.091	-0.087	5.520	-19.059	0.620	1.733	23.442	0.593	0.675
4	Experiment Product	UWAI-034	2.526	0.694	31.575	23.175	-0.065	5.974	-19.284	0.642	1.870	23.579	0.629	0.711
4	Experiment Product	UWAI-035	-1.266	-3.546	27.204	18.840	-0.227	1.976	-6.774	0.590	-0.956	19.177	0.578	0.660
4	Experiment Product	UWAI-036	1.078	-2.055	28.742	20.365	-0.175	3.700	-12.276	0.587	-0.203	19.251	0.538	0.620
4	Experiment Product	UWAI-037	0.530	-2.294	28.496	20.120	-0.161	3.337	-11.459	0.615	-0.678	19.185	0.585	0.667
4	Experiment Product	UWAI-038	0.538	-2.328	28.460	20.085	-0.157	3.298	-11.288	0.620	-0.610	19.182	0.592	0.674
4	Experiment Product	UWAI-039	0.711	-2.202	28.591	20.215	-0.165	3.650	-11.912	0.606	-0.553	19.204	0.569	0.651
4	Experiment Product	UWAI-040	1.450	-1.883	28.919	20.540	-0.152	3.811	-13.077	0.603	-0.049	19.115	0.556	0.638
4	Experiment Product	UWAI-041	0.601	-2.242	28.549	20.173	-0.157	3.461	-11.357	0.617	-0.623	19.221	0.588	0.670
4	Experiment Product	UWAI-042	0.572	-2.256	28.534	20.159	-0.184	3.486	-11.483	0.587	-0.702	19.169	0.543	0.625
4	Experiment Product	UWAI-043	0.773	-2.181	28.611	20.235	-0.181	3.713	-12.237	0.586	-0.546	19.162	0.539	0.621
4	Experiment Product	UWAI-044	1.484	-1.746	29.060	20.680	-0.138	4.105	-13.711	0.617	-0.122	19.231	0.577	0.659
4	Experiment Product	UWAI-045	2.227	-0.464	30.382	21.991	-0.097	5.149	-16.844	0.630	1.086	21.469	0.604	0.686
4	Experiment Product	UWAI-046	2.044	-0.508	30.336	21.946	-0.109	4.956	-16.466	0.619	0.798	21.409	0.586	0.668
4	Experiment Product	UWAI-047	0.948	-2.039	28.758	20.380	-0.153	4.014	-13.580	0.614	-0.252	19.407	0.581	0.663
4	Experiment Product	UWAI-048	0.945	-2.041	28.756	20.379	-0.148	3.896	-12.551	0.619	-0.419	19.264	0.588	0.670

Table S4 (cont): Carbon, Oxygen, and Clumped Isotope Data Reprocessed with "Brand" Parameters

			Bulk Values								Overgrowth Correction by Isotope Dilution			
	Measurement		$\delta^{13}C$	$\delta^{18}O$ gas	$\delta^{18}O$ gas	$\delta^{18}O$ mineral	Δ_{47} raw	Δ_{48} raw	Δ_{49} raw	Δ_{47} ARF	$\delta^{13}C$	$\delta^{18}O$ mineral	Δ_{47} mixing	Δ_{47} acid
Week	Type	Name	VPDB (‰)	VPDB (‰)	VSMOW (‰)	VSMOW (‰)	(v. Oz)	(v. Oz)	(v. Oz)	Corrected	VPDB (‰)	VSMOW (‰)	Corrected	Corrected
5	Experiment Product	UWAI-003	1.361	0.187	31.053	22.657	-0.130	9.816	-21.732	0.578	-0.409	22.214	0.544	0.626
5	Experiment Product	UWAI-023	0.918	-0.733	30.104	21.716	-0.150	4.506	-20.872	0.574	0.314	21.419	0.563	0.645
5	Experiment Product	UWAI-023	0.738	-0.816	30.019	21.632	-0.135	4.380	-20.217	0.596	0.102	21.320	0.588	0.670
5	Experiment Product	UWAI-024	0.885	-0.850	29.984	21.597	-0.110	4.023	-18.930	0.624	0.430	21.360	0.622	0.704
5	Experiment Product	UWAI-024	3.144	1.179	32.075	23.671	-4.327	0.840	-26.217	0.609	0.233	21.226	0.605	0.687
5	Experiment Product	UWAI-025	3.085	1.123	32.018	23.614	-0.027	5.384	-24.575	0.656	1.218	23.919	0.694	0.776
5	Experiment Product	UWAI-025	3.176	1.226	32.124	23.719	-0.021	6.848	-25.070	0.659	1.442	24.178	0.702	0.784
5	Experiment Product	UWAI-025	3.085	1.123	32.018	23.614	-0.027	5.885	-24.575	0.654	1.218	23.919	0.654	0.736
5	Experiment Product	UWAI-026	3.052	1.106	32.000	23.596	-0.048	5.477	-24.470	0.632	1.147	23.873	0.634	0.716
5	Experiment Product	UWAI-027	3.244	1.131	32.026	23.622	-0.038	5.736	-26.486	0.640	0.952	24.066	0.659	0.741
5	Experiment Product	UWAI-027	3.263	1.166	32.062	23.657	-0.023	6.092	-23.986	0.656	1.010	24.174	0.710	0.792
5	Experiment Product	UWAI-028	3.347	0.997	31.888	23.485	-0.040	5.518	-25.696	0.638	1.189	23.653	0.653	0.735
5	Experiment Product	UWAI-028	3.396	1.126	32.020	23.617	-0.026	6.312	-24.221	0.651	1.343	24.065	0.696	0.778
5	Experiment Product	UWAI-029	3.130	1.063	31.956	23.553	-0.040	5.591	-24.796	0.640	1.305	23.770	0.654	0.736
5	Experiment Product	UWAI-029	3.144	1.179	32.075	23.671	-0.012	7.766	-26.217	0.670	1.342	24.064	0.730	0.812
5	Experiment Product	UWAI-032	2.885	1.194	32.090	23.686	-0.038	6.036	-26.734	0.645	0.871	24.068	0.664	0.746
5	Experiment Product	UWAI-033	2.578	1.084	31.977	23.574	-0.066	6.193	-26.913	0.618	1.500	23.675	0.611	0.693
5	Experiment Product	UWAI-033	2.584	1.225	32.123	23.718	-0.025	6.517	-24.079	0.663	1.509	23.907	0.683	0.765
5	Experiment Product	UWAI-034	2.627	1.122	32.017	23.613	-0.044	6.082	-26.894	0.643	1.529	23.744	0.650	0.732
5	Experiment Product	UWAI-034	2.651	1.135	32.030	23.626	-0.062	6.788	-27.121	0.621	1.568	23.766	0.615	0.697
5	Experiment Product	UWAI-037	0.642	-1.881	28.921	20.542	-0.150	3.216	-16.448	0.596	-0.961	19.305	0.575	0.657
5	Experiment Product	UWAI-038	0.648	-1.822	28.982	20.602	-0.151	3.372	-16.069	0.595	-0.893	19.437	0.574	0.656
5	Experiment Product	UWAI-038	0.722	-1.699	29.109	20.729	-0.170	3.985	-18.949	0.570	-0.788	19.615	0.539	0.621
5	Experiment Product	UWAI-041	0.762	-1.702	29.105	20.725	-0.157	3.763	-16.993	0.584	-0.838	19.531	0.557	0.639
5	Experiment Product	UWAI-042	0.799	-1.688	29.120	20.740	-0.162	3.429	-16.600	0.577	-0.823	19.524	0.547	0.629
5	Experiment Product	UWAI-042	0.827	-1.644	29.165	20.785	-0.166	4.470	-19.295	0.573	-0.782	19.589	0.540	0.622
5	Experiment Product	UWAI-044	1.626	-1.230	29.592	21.208	-0.121	3.835	-18.605	0.606	-0.416	19.563	0.579	0.661
5	Experiment Product	UWAI-045	2.344	0.027	30.887	22.493	-0.095	4.860	-22.704	0.604	0.739	21.764	0.580	0.662
6	Experiment Product	UWAI-030	3.232	1.132	32.027	23.623	-0.056	6.536	-24.990	0.646	1.241	24.006	0.674	0.756
6	Experiment Product	UWAI-035	-1.076	-3.151	27.612	19.244	-0.202	2.507	-13.991	0.615	-1.076	19.244	0.615	0.697
6	Experiment Product	UWAI-036	1.222	-1.573	29.239	20.858	-0.123	3.803	-18.936	0.647	-0.459	19.491	0.649	0.731
6	Experiment Product	UWAI-037	0.823	-1.552	29.260	20.878	-0.190	4.685	-20.532	0.566	-0.702	19.787	0.532	0.614
6	Experiment Product	UWAI-039	0.825	-1.757	29.048	20.669	-0.192	3.859	-18.905	0.567	-0.842	19.376	0.531	0.613
6	Experiment Product	UWAI-040	1.632	-1.338	29.480	21.097	-0.119	4.471	-21.568	0.640	-0.267	19.487	0.639	0.721
6	Experiment Product	UWAI-041	0.737	-1.771	29.034	20.654	-0.144	3.295	-16.832	0.632	-0.876	19.428	0.626	0.708
6	Experiment Product	UWAI-042	0.827	-1.644	29.165	20.785	-0.191	3.983	-19.295	0.566	-0.782	19.589	0.530	0.612
6	Experiment Product	UWAI-043	1.002	-1.584	29.227	20.846	-0.174	4.047	-18.683	0.583	-0.668	19.572	0.553	0.635
6	Experiment Product	UWAI-044	1.626	-1.230	29.592	21.208	-0.174	4.583	-18.605	0.616	-0.416	19.563	0.597	0.679
6	Experiment Product	UWAI-046	2.186	-0.034	30.825	22.430	-0.102	5.270	-23.934	0.627	0.498	21.671	0.621	0.703
6	Experiment Product	UWAI-047	0.912	-1.610	29.200	20.819	-0.166	3.515	-17.700	0.597	-0.766	19.558	0.574	0.656
6	Experiment Product	UWAI-048	1.023	-1.539	29.274	20.892	-0.137	3.839	-19.331	0.631	-0.776	19.535	0.625	0.707
6	Experiment Product	UWAI-048	1.087	-1.436	29.379	20.997	-0.154	3.865	-19.560	0.607	-0.678	19.696	0.587	0.669
7	Experiment Product	UWAI-026	3.078	1.153	32.048	23.644	-0.015	6.827	-20.617	0.642	1.185	24.189	0.659	0.741
7	Experiment Product	UWAI-031	2.443	1.084	31.977	23.573	-0.030	6.887	-19.881	0.640	0.260	23.933	0.650	0.732
7	Experiment Product	UWAI-031	2.351	1.064	31.956	23.553	-0.032	7.052	-19.626	0.639	0.064	23.889	0.650	0.732
7	Experiment Product	UWAI-031	2.395	1.062	31.955	23.551	-0.025	6.552	-19.583	0.646	0.157	23.886	0.664	0.746
7	Experiment Product	UWAI-032	2.799	1.072	31.965	23.562	-0.014	6.750	-20.228	0.650	0.645	23.964	0.678	0.760
7	Experiment Product	UWAI-032	2.820	1.098	31.991	23.588	-0.025	7.110	-20.292	0.637	0.695	24.026	0.646	0.728
7	Experiment Product	UWAI-035	-1.123	-3.224	27.536	19.169	-0.242	2.599	-7.432	0.559	-1.133	19.249	0.559	0.641
7	Experiment Product	UWAI-035	-1.079	-3.186	27.576	19.208	-0.226	2.780	-7.744	0.575	-1.089	19.288	0.575	0.657
7	Experiment Product	UWAI-036	1.161	-1.483	29.332	20.950	-0.145	4.336	-13.425	0.587	-0.567	19.755	0.558	0.640
7	Experiment Product	UWAI-036	1.219	-1.559	29.252	20.871	-0.156	4.156	-13.233	0.575	-0.479	19.634	0.539	0.621
7	Experiment Product	UWAI-039	0.734	-1.497	29.316	20.934	-0.164	4.164	-13.108	0.574	-0.991	19.885	0.541	0.623
7	Experiment Product	UWAI-039	0.848	-1.728	29.078	20.698	-0.155	4.033	-12.559	0.587	-0.824	19.538	0.560	0.642
7	Experiment Product	UWAI-040	1.561	-1.363	29.455	21.072	-0.132	4.362	-14.163	0.592	-0.404	19.580	0.557	0.639
7	Experiment Product	UWAI-040	1.619	-1.332	29.487	21.104	-0.112	4.419	-14.174	0.613	-0.305	19.635	0.593	0.675
7	Experiment Product	UWAI-043	0.962	-1.730	29.077	20.697	-0.126	3.987	-12.692	0.618	-0.743	19.468	0.605	0.687
7	Experiment Product	UWAI-043	0.987	-1.616	29.194	20.813	-0.123	4.291	-12.913	0.618	-0.706	19.641	0.606	0.688
7	Experiment Product	UWAI-045	2.376	0.063	30.925	22.530	-0.066	5.795	-17.753	0.620	0.778	21.975	0.610	0.692
8	Experiment Product	UWAI-002	1.208	-0.389	30.459	22.068	-0.097	5.154	-15.653	0.636	-0.201	21.468	0.635	0.717
8	Experiment Product	UWAI-003	1.463	-0.254	30.598	22.206	-0.088	5.284	-16.079	0.639	-0.246	21.496	0.641	0.723
8	Experiment Product	UWAI-011	1.637	-0.245	30.607	22.215	-0.121	5.437	-16.243	0.601	0.324	21.639	0.584	0.666
8	Experiment Product	UWAI-023	0.714	-0.816	30.018	21.631	-0.128	4.599	-14.294	0.618	0.075	21.319	0.614	0.696
8	Experiment Product	UWAI-024	0.681	-0.877	29.956	21.569	-0.134	4.686	-14.075	0.613	0.200	21.328	0.610	0.692
8	Experiment Product	UWAI-027	3.281	1.192	32.089	23.685	-0.043	6.899	-20.673	0.632	1.065	24.257	0.635	0.717
8	Experiment Product	UWAI-029	3.165	1.182	32.079	23.674	-0.041	6.812	-20.609	0.636	1.394	24.072	0.644	0.726
8	Experiment Product	UWAI-029	3.163	1.226	32.123	23.719	-0.076	6.863	-20.664	0.599	1.389	24.183	0.552	0.634
8	Experiment Product	UWAI-033	2.612	1.233	32.131	23.726	-0.034	6.622	-20.099	0.652	1.555	23.920	0.666	0.748
8	Experiment Product	UWAI-034	2.646	1.207	32.104	23.699	-0.051	6.856	-20.150	0.633	1.559	23.885	0.635	0.717
8	Experiment Product	UWAI-037	0.690	-1.684	29.124	20.744	-0.175	3.902	-12.281	0.583	-0.893	19.594	0.556	0.638
8	Experiment Product	UWAI-038	0.701	-1.728	29.078	20.698	-0.189	4.045	-12.203	0.568	-0.818	19.572	0.536	0.618
8	Experiment Product	UWAI-041	0.727	-1.744	29.062	20.682	-0.160	3.896	-12.046	0.600	-0.889	19.468	0.579	0.661
8	Experiment Product	UWAI-044	1.653	-1.027	29.801	21.416	-0.154	4.521	-14.787	0.577	-0.369	19.926	0.529	0.611
8	Experiment Product	UWAI-045	2.353	0.155	31.020	22.624	-0.111	5.856	-17.684	0.593	0.755	22.000	0.560	0.642
8	Experiment Product	UWAI-046	2.134	-0.040	30.819	22.425	-0.068	5.647	-17.073	0.646	0.406	21.661	0.654	0.736
8	Experiment Product	UWAI-046	2.217	0.065	30.927	22.532	-0.118	5.901	-17.410	0.589	0.553	21.851	0.554	0.636
8	Experiment Product	UWAI-047	0.929	-1.479	29.336	20.954	-0.144	4.148	-13.095	0.609	-0.740	19.758	0.592	0.674
8	Experiment Product	UWAI-048	1.085	-1.409	29.407	21.025	-0.184	4.083	-13.368	0.562	-0.681	19.739	0.518	0.600
9	Experiment Product	UWAI-028	3.145	1.143	32.038	23.634	-0.039	6.803	-20.360	0.618	0.555	24.119	0.590	0.672
9	Experiment Product	UWAI-030	3.262	1.178	32.075	23.670	-0.036	6.775	-20.708	0.619	1.325	24.137	0.598	0.680
9	Experiment Product	UWAI-030	3.289	1.144	32.039	23.635	-0.034	6.680	-20.740	0.620	1.400	24.039	0.603	0.685